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Notes of the Month

TANGANYIKA COTTON

TANGANYIKA cotton is a product about which more textile manufacturing countries should know and every effort must be made to ensure that they do, says the recent annual report of the Lint and Seed Marketing Board. "Tanganyika cotton is popular in the trade where it is known—but where is it known? Unfortunately in only a very few of the many countries with textile manufacturing industries, and even in those only a small percentage of the spinners use our cottons. With the present depression in the world textile trade, declining prices of cotton and strong competition from artificial fibres, Tanganyika cannot afford to relax and depend on a few traditional markets. Every effort must be made to extend these by advertisements and articles in trade journals, the supply of free samples and the dissemination of as much technical information as possible."

The report, which is for the year which ended 30th June, 1958, says that the period under review was one of transition, but of great importance to the Board. As a result of an amendment to the Lint and Seed Marketing Ordinance, the Board became responsible to the Minister for Natural Resources, and the Director of Agriculture replaced the latter as chairman; and various other changes also occurred in the composition of the Board. The amendments also necessitated vital adjustments in the marketing arrangements between ginners and the Board. The major change was caused by the fact that in the past, all lint and seed had automatically become the property of the Board as it fell from the gin, whereas under the amended law, the ginner was compelled to sell all his lint and seed to the Board and to enter into a written contract for such sales. It therefore became necessary to negotiate contracts and draw up terms and agreements to cover all eventualities.

Following a decision made by the Board in June 1957, a new manager and permanent specialist staff were recruited both for the head office in Dar es Salaam and in Mwanza, and they prepared plans to take over full administration of the Board's affairs, including marketing of the crops in the 1958 season, previously undertaken by agencies. The report says that although sufficient funds have to be left with the agencies marketing the crops, it had been the Board's constant policy to repatriate monies as and when possible, and employ them on short or long term deposits to a better advantage than in the past. Accordingly arrangements were made with the Tanganyika Government to accept these funds on various terms, depending on the length of deposit and the rates ruling at the time. A maximum of £1,400,000 was deposited in this way, and as a result during the year £52,690 was earned in interest on the Board's liquid funds compared to £16,374 earned in the same manner in the season before.

The report adds that selling commissions costing £21,842 and expenses incurred in establishing a new house and staff had to be deducted from this amount, but the increase amply covered the extra expenses. Next year no commissions would be paid out, as all marketing would be carried out by the Board's permanent staff. During the year under review, the Board continued its policy of grants towards the upkeep of the research stations at Namulonge, Ukiriguru and Ilonga, and sums were voted for the cost of a new water supply scheme and an adequate electrical installation at the Ukiriguru station, although the latter were not paid out during the period under review. In the Eastern Province Cotton Committee Annual Report—an appendix to the main report—the committee's executive officer says that various forms of propaganda for increasing cotton production were undertaken during the year, the most effective being the organised parties of African cotton growers of the Province, who visited the Central Regional Research Centre at Ilonga.

PROGRESS IN THE U.K. JUTE INDUSTRY

GIVING a review of progress in the U.K. jute industry at the recent annual meeting of the British Jute Trade Federal Council, Mr. T. D. Bruce, retiring chairman, said the large sums spent on the modernisation of the industry in recent years had resulted in labour productivity rising at a rate well in advance of the average for manufacturing industry in the U.K. The total sum now expended under this plan was over £11 million. During 1958 the reinvestment was £418,000, a figure lower than in other post-war years, which reflected the prevailing uncertainty as to the government's intentions. "But we have all been conditioned to believe in efficiency, and it will take a lot to put us off," he said. "During the past year there has been a renewed emphasis on raising efficiency and quality standards to a new peak by modern management methods. Research and development, which is the expression of an intention to plan future

"Textile Manufacturer" Index

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progress, has increased steadily, and new fields are opening which could expand the use of our versatile fibre."

Mr. Bruce said that there had been a welcome improvement in demand for certain types of jute goods starting last summer after the quiet spell symptomatic of the general trade recession in the country. Sack-sewers, apart from the trade climate, had been facing intense competition. On the merchanting and sales side, the search for new and the extension of old markets had continued unabated. For spinners and manufacturers, the B.o.T. decision in 1957 to reduce safeguards against imported cloth from the East had logical effect. More cloth had been imported, particularly for bag-making, at the expense of home-woven cloth. As a result, the industry had become more compact owing to the necessity of trimming back and reorganising its labour force.

Dealing with the raw jute position, Mr. Bruce said this was the starting point in many of the trade's problems. Plentiful jute in right qualities at the right price would remove many of the difficulties which beset world jute industries. "For years now we have been dependent for our raw material on a country which has been in a chronic state of political instability and which was on the verge of economic collapse last autumn. It has been the belief of Pakistan, prevalent in more than one primarily agricultural country, that prosperity can be achieved only through a rapid flight from agriculture to industry. To industrialise may be sound policy, but side by side with it has been the neglect of agricultural production, the main source of foreign exchange for Pakistan. Thus the illogical situation of Pakistan reducing acreage in areas ideally suited to grow fine quality jute, at a time when it was vital to maintain exports of jute at the highest possible level.

"The effect of all this has been to create trouble for Pakistan, and trouble for the jute consuming countries in these past years. It has damaged the world jute position, created scarcities and uncertainties, and has led to undue price fluctuations, which add greatly to the commercial hazards of industrial planning by jute firms and users of jute goods. It has also encouraged other countries to grow their own jute or other long-fibred plants having the essential properties of jute, a development of which the Pakistan monopoly must take heed. Fortunately, there is evidence that the new regime in Pakistan, consisting of civil and military personnel is aware of the problem. Some initial steps have been taken to restore stability and get the economy into balance.

WORK STUDY IN WOOL TEXTILES

IT is estimated that the Work Study Centre of the British wool textile industry is saving the industry about £250,000 per year by encouraging the introduction of newer aids to more effective mill management and by suggesting significant improvements in productive efficiency. In announcing this fact, the "Wool Textile Bulletin"—the official organ of the Wool Textile Delegation and of the Wool Export Group—describes the progress of the industry's Work Study Centre which was inaugurated in 1954 and run by a principal assisted by two consultant instructors. Now the staff totals thirteen operating over all sections of the industry and in recent years the centre has made consultants available for carrying out assignments in individual mills. This type of work, it is pointed out, has increased considerably and in 1958 about 250 consultant weeks of work were carried out compared with about 20 in 1955. The demand for training courses in work study has remained fairly steady and so far 122 trainees have attended these, the majority having returned to their mills and secured significant improvements in productive efficiency.

The work done, says the Bulletin, has ranged from the revision of methods and redeployment of individual departments, right through to the re-organisation of the production activities of whole mills. These involve the installation of improved work planning and control procedures. Such investigations, extending over several months, have resulted in savings of several thousands to the firms concerned. Because work study is concerned with work methods and setting up equitable systems of payment by results it is something which is of direct concern to the labour force in the industry. Trade unions have accepted the part which work study can play in making the wool textile industry more competitive. The employers' council has made places available on the centre's courses for the unions so that their officials could have a greater understanding of the subject.

INTERNATIONAL COTTON TRADE

REPORTS in the latest issue of "International Review of Cotton and Allied Textile Industries" reveal that, in general, spinning and weaving activities remained unsatisfactory and has not yet shown much improvement. In Austria, yarn production decreased in the third quarter of the year by 16%. In the same period, not only was production of spun rayon fabrics 22% less than in 1957 but production of cotton fabrics also showed a decrease of 2%.

Yarn production in Belgium during the fourth quarter of 1958 was 21,095 tons compared with 24,605 tons in the same period in 1957. In weaving, production was estimated to have been 15% lower in the fourth quarter of 1958 than in the corresponding period in 1957. Cloth sales on the domestic market were also 30% lower than during the fourth quarter of 1957. Cloth exports were estimated to be still 10% below the level reached in the corresponding quarter in 1957. In the Federal Republic of Germany yarn stocks were still very high. During the fourth quarter of 1958 they were approximately 70% more than the same period in 1957. In the period July/Oct. 1958 cotton yarn exports were 50% below the level in the same period in 1957. Cloth production in the fourth quarter of 1958 was 357 million sq. metres compared with 395 million in the same quarter in 1957. In numerous factories—particularly in the grey weaving section—hours of work had been reduced still further and, in addition, the numbers employed had been cut down.

Activity in France was similarly reduced. At the end of 1958 there were 5,210,565 cotton spindles active and 101,089 looms as against 5,398,815 and 104,709 respectively in October. Stocks in the mills showed a considerable increase, i.e., 19,812 tons of yarn and 78,711 tons of cloth compared with 17,569 and 77,359 respectively in October. In the U.K. the level of activity continued to be unsatisfactory and yarn output in the fourth quarter was 17% lower than the same period in 1957. Exports of cotton yarn declined once more; in the final quarter of 1958 the level was 28% below that attained in the fourth period of 1957. The number of mule equivalent spindles in place suffered further contraction, the total at the end of December having fallen to 24·89 million.

The situation in the Netherlands cotton, rayon and linen industry showed a lower rate of activity in the first nine months of 1958 than in the corresponding period of the preceding year. Deliveries in the home market were at a rather low level, showing a decline of 16%. Cloth imports in the third quarter were 14·8% below the corresponding level in 1957. Fabric exports Jan./Sept. 1958 stood at 26,883 metric tons compared with 25,329 in the same period in 1957.

Cotton: Production and Trade

"There are, in India, trees growing wild, of which the fruit is wool, greater in beauty and fineness than sheep's wool"
— HERODOTUS (445 B.C.)

By J. W. S. HEARLE, M.A., PH.D., A.INST.P.*

COTTON, a fibre that has been in use for at least 5,000 years, is still in far greater use than any other fibre. More than half the total world production of textiles is cotton and every industrial country has a cotton industry; in fact, in developing countries it is usually the first industry to be set up. Cotton is a diverse fibre. It derives from several species and production can be annual or perennial. The varieties range from short, coarse Asiatic cottons to the long, fine, Sea Island staple; it is manufactured into a seemingly limitless range of domestic and industrial goods from sacks to evening dresses and from ropes to fine gauze. Indeed, it is probably true to say that anything which can be made of fibres has already been made of cotton, sometimes as a cheaper substitute, e.g., in carpets alone or in blends and in many cases as the finest fibre obtainable for high quality purposes such as the very best poplin shirtings, etc.

Cotton can be modified in order to change or improve its properties and extend its usefulness. Mercerisation, a long-established process, is still extensively employed to improve the strength and lustre of cotton fabrics. Acetylation has been used for a number of years to improve the electrical insulation of cotton; and now, as a result of work by the U.S. Department of Agriculture, this and other processes are increasing cotton's resistance to rotting. Similarly, for dress fabrics, drip-dry and crease-resist finishes are making cotton garments easier to care for. With these advances and aided by publicity—particularly from organisations such as the National Cotton Council in the U.S.A.—cotton continues to more than hold its own in competition with the other fibres—vegetable, animal or man-made.

* *Manchester College of Science and Technology.*

The origins of cotton are lost in antiquity. Archaeologists have discovered remnants of cotton fabrics and string on a site at Sind which has been dated as 3,000 B.C. Cotton was undoubtedly known to the ancient Egyptians, Hebrews, Greeks, and Romans but, along with much else the knowledge almost died with the Roman Empire. India remained the centre of the cotton industry until A.D. 1500, but cotton was also known and used in Arabia, and from there it spread Westwards again. The Mahomedan conquests of A.D. 800 - 1000 brought a cotton industry to Spain, the first, incidentally, to be established in Europe.

Concurrently with its spread through the Old World, cotton was also used by the American Indians, e.g., by the Mayas in 600 B.C. As the Spaniards explored Central and South America, following their discovery by Columbus, they found the native inhabitants wearing cotton clothes. In North America, the British colonists first tried to cultivate cotton in 1621 in Virginia. At about the same time, a cotton manufacturing industry was started in England. But it was near the end of the next century, before the great exports of American cotton commenced and the Lancashire cotton industry began its vast expansion, accompanying the industrial revolution. These two developments set the modern pattern. Since then, both cotton growing and cotton processing have extended to many other countries.

(left) Fig. 1. The cotton plant

(courtesy, Cotton Board)

(right) Fig. 2. Section through cotton boll before opening, showing fibres developing and one of the pests to which cotton is subject—the feeding larvae of the pink boll worm

(left) Fig. 3. Open cotton boll showing stem and locks (courtesy, Cotton Board)

(right) Fig. 5. Two-row cotton stripper (courtesy, National Cotton Council)

The Cotton Plant

Botanically, the cotton plant (Fig. 1) is derived from several species of the genus Gossypium, and was probably domesticated independently in the old and the new worlds. The wild varieties, distinguished by a woolly coating on their seeds and only a few short hairs, are useless commercially; but by careful selection, high-yielding cotton plants with long fine fibres have been cultivated and further developed. There are about 20 species of Gossypium, but for all practical purposes the cultivated cottons can be grouped into four of commercial importance:—

OLD WORLD SPECIES

G. arboreum—a tree cotton growing up to 15 ft. high, and including the Asiatic cottons of India and China.
G. herbaceum—a shrub cotton, 2 to 6 ft. tall, including the native cottons of the Near East and Central Asia, and also grown in India.

NEW WORLD SPECIES

G. hirsutum—a shrub growing up to 6 ft. tall, and including the American Upland varieties.
G. barbadense—a tall shrub, up to 10 ft. high, including Sea Island, Peruvian Tanguis, Egyptian, and Nigerian Ishan cottons.

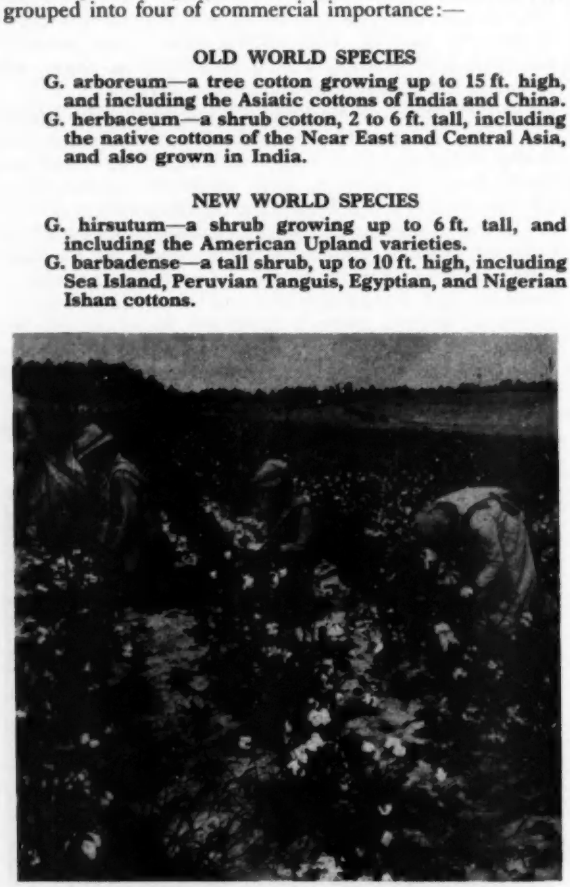


Fig. 4. Hand picking of cotton (courtesy Cotton Board)

There is an important genetical difference between these two groups. The old world species, and all the wild species so far tested, have a chromosome number of 13, while in the new world species this has been doubled to 26. Cotton plant breeding by crossing varieties of the same species, and selection of the best progeny, has been carried on for a long time. More recently, the use of special techniques has made crossing between different species possible, even when the chromosome numbers are different. Consequently, many hybrid varieties have been produced. In cotton breeding, a clear objective is essential—this may be increased yield, better fibres, resistance to disease or attack, or adaptation to a new growing territory. In addition to the random improvements which may occur as a result of crossing or mutations, it is often possible to transfer particular qualities from one variety to another. For instance, crosses with Sea Island cotton have resulted in longer staple American Upland cottons; and crossing with the Asiatic varieties has introduced resistance to bacterial blight in Egyptian cottons.

There has been some crossing with wild or semi-cultivated varieties. For example, the Hopi cotton, a native American variety used by the Hopi Indians in Arizona for centuries, is now being tried in a cross with the American Upland Acala variety. By all these methods, a vast number of varieties of cotton have been produced. In 1937, over 1,200 strains were being grown at the United States Experimental Station at Stoneville, Mississippi. In the tropics, the cotton plant grows naturally as a perennial shrub or tree, but further from the Equator it may be killed by frosts and so occurs only as an annual. Commercially it is usually grown as an annual, since this gives better plants and allows for crop rotation. The Northern limit of cultivation is Southern Europe.

Cotton Growing

The growth of cotton usually takes six months from seed-time to harvest. About three months after planting, the plant flowers, is fertilised, and seeds form. From the surface of the seeds, the fibres develop. Each fibre is a single cell, which first grows out to its full length as a thin-walled hollow tube, and then thickens by the deposition of cellulose as a secondary wall on the inside of the cell. All this takes place within the closed cotton boll (Fig. 2). When the thickening is complete and the fibres are mature, the

boll bursts open, and the fibres dry in the sun (Fig. 3). If the development of a fibre is arrested for any reason, e.g., by injury or disease, or by frost causing the boll to open prematurely, the result is a thin-walled, *immature* fibre with a wide lumen.

Most of the world's cotton is harvested by hand (Fig. 4). This laborious occupation, often necessitates crawling along on hands and knees through the cotton fields, trailing a long sack, and taking about 15 days to pick a bale of cotton (500 lbs.). But where labour is cheap, there is little incentive to change. However, in the United States, labour is no longer cheap, and, as will be observed from Table 1,

Table 1. Mechanical Harvesting of Cotton

Year	No. of spindle pickers	No. of mechanical strippers	% of crop mechanically harvested
1949 ..	2,960	6,500	6
1951 ..	7,325	13,735	15
1953 ..	14,456	17,975	22
1955 ..	18,644	23,122	23

mechanical harvesting has increased rapidly since the last war, until now about a quarter of the crop is picked mechanically. There are two methods of harvesting by hand. In hand-picking, the locks of cotton are pulled away from the rest of the cotton boll, and the operation must be repeated several times as the bolls open. In snapping or pulling the whole crop can, if desired, be collected at once, as the bolls, whether open or not, are pulled off whole, hull, burrs, and all. The cost of harvesting is lower where snapping is employed, but picking produces cleaner cotton and reduces the cost of ginning. In the final cost of a bale of ginned cotton, there may not be much difference between the two methods: the choice between them depends on the type of crop and conditions of harvesting. Picking is preferred where there are heavy crops of good cotton.

The mechanisation of harvesting is difficult since (*a*) cotton bolls do not all mature at the same time, (*b*) because cotton is easily damaged and (*c*) the cotton is not as clean in that picking is not selective. There are now two types of mechanical harvesters in use. Mechanical strippers (Fig. 5) have derived from a third method of hand harvesting known as sledding. In this method, a coarse rake was employed to pull the bolls off the plant. In the mechanical version, the plants are pulled through a narrow slit as the machine travels along the rows. The stripped bolls, stalks, and so on are all fed back into a trailer

Fig. 6. Two-row International Harvester mechanical cotton pickers (courtesy National Cotton Council)

Fig. 7. Cotton being delivered to a gin (courtesy Cotton Board)

behind. This is the most suitable method where poor crops that can be left until all the cotton is mature are concerned. If this is harvested after the first frosts, the leaves will already have fallen off the plants; but, otherwise, a defoliant may be used to remove them. A more discriminating type of harvester is the spindle picker (Fig. 6), in which revolving spindles passing over the plant engage any opened bolls and pull off the cotton. Spindle pickers are decidedly more valuable in crops giving high yields of good cotton. The main use of cotton strippers has been in the great plains of Texas and Oklahoma, while spindle pickers have been most used in the states of the south-west and mid-south. So far, few, if any, mechanical harvesters have been used outside the U.S.A.

After harvesting, the cotton goes to the gin (Fig. 7), which may be regarded either as (*a*) the last stage of raw cotton production or (*b*) the first stage of mill processing. The primary purpose of ginning is to separate the cotton fibres from the seeds, which amount to two-thirds of the total weight and are a useful by-product. Other functions of the gin are the extraction of hulls, burrs, and stalks, and the partial removal of dirt and trash. There may also be a preliminary drying operation if necessary. There are two types of cotton gin in general use. In roller gins, the fibres are drawn along on a roller past a knife blade. The gap is too small for the seed to pass through, and they are therefore cut off, while the fibres pass through. This type of gin is used for short Indian cottons, and for long-staple Egyptian and Sea Island cottons. Saw gins have a greater rate of production but are more severe on the cotton. The machine has about 80 cylindrical saws passing between metal ribs on the surface of a hopper. The cotton is fed into the hopper, and the saws pull the fibres through the slots and leave behind the seeds.

After ginning, cotton is baled in low density bales. These are usually about 500 lbs. in weight, but vary from 200 lbs. in the Belgian Congo to 720 lbs. in Egypt. For long-distance transport, the bales are compressed to higher densities in special presses installed at the ports or railheads. For example, American bales, which are 500 lbs.

gross weight (480 lbs. nett, allowing 20 lbs. for ties and coverings) are found in the following sizes:—

(1) **Square bales: 45 × 54 × 27 ins. — 12·14 lbs./cu. ft. (specific gravity = 0·2)**

(2) **Standard bales: 20 × 56 × 28 ins. — 25·30 lbs./cu. ft. (specific gravity = 0·4)**

(3) **High density bales: 19 × 59 × 24 ins. — 32 lbs./cu. ft. (specific gravity = 0·5)**

The specific gravity of cellulose is 1·5, which shows that even high-density bales are two-thirds air.

Cotton Marketing

Cotton bales are the form in which cotton is sold by the producers, and bought by the spinners. But between the two there are complicated marketing processes. Some of the complication is financial, but the cotton merchants also have technical functions. Cotton is produced in great variety and often in small and ill-assorted lots. For it to be utilised efficiently by the textile industry, it has to be graded and sorted out into even running lots. Uniformity is highly important and the spinner must be in the position to order the type of cotton required for his particular yarns. In the large U.S. textile combines, the cotton buyer may be able to perform these functions himself, by choosing the cotton which he buys on the basis of a wealth of experience of raw cotton, and a knowledge of what sort of cotton is being grown in different localities. But for smaller mills and most users of imported cotton, the raw material must be classified for the spinner by the merchant.

The financial complications of marketing derive from several causes. Firstly, in order to finance the cost of growing, harvesting, ginning, and carrying stocks of cotton, a system of *forward selling* of cotton has grown up. The supplier agrees to supply cotton at a later date, and so the capital needed by the small producer can be provided by merchants. Secondly, those holding stocks, or involved in forward selling, need insurance against changes in the market price. This increases the amount of forward buying and selling, or hedging, by merchants, cotton growers, and cotton mills. Thirdly, since these are only paper transactions, they provide considerable opportunities for speculation. Finally, Government actions have upset the working of the free market as it operated before the war. These have taken the form of control of production, guarantee of reserve prices, and the introduction of central purchasing and marketing agencies.

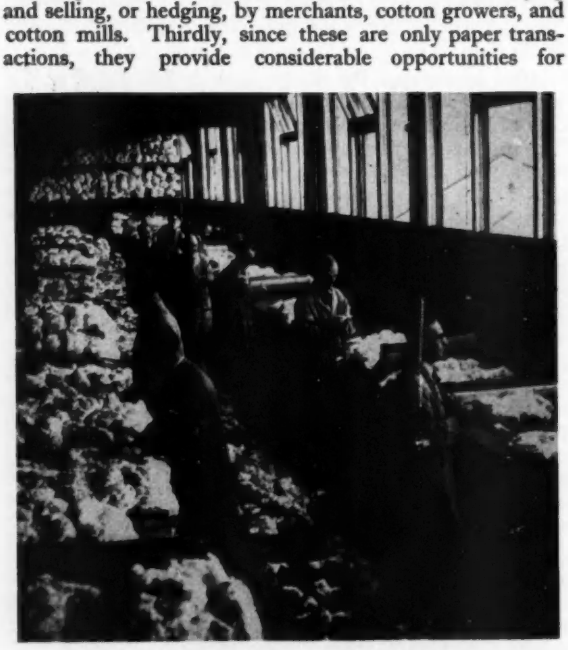


Fig. (8). American cotton classing room (courtesy, Cotton Board)

Table 2. Cotton Production and World Trade

(A) Main Exporting Countries

Country	Production	Exports	Imports by U.K. (1956)	Home Consumption
United States*	6,652	3,797§	260	4,119
India†	2,007	107	21	2,151
Mexico	846	653	32	225
Egypt	699	476	17	196
Pakistan	669	232	21	404
Brazil	645	182	53	502
Turkey	364	115	4	215
Sudan	250	157	111	—
Syria	250	143	10	—
Argentina	231	50	1	263
Peru	215	191	48	36
Uganda	148	127	15	—
Iran	138	78	—	43
Belgian Congo	120	112	6	20
Greece	119	90	—	59
Nicaragua	90	79	—	—
French Eq. Africa	79	83	—	—
Nigeria	69	62	61	—
Salvador	68	62	—	—
Mozambique	67	50	—	—
Tanganyika	56	62	4	—
Angola	15	13	—	—
Other countries	—	162¶	88‡	—

* Also imports special type—see (C).

† Net importer—see (C).

§ Three times greater than in recent years, as a result of disposal of surplus stocks.

¶ Free world.

‡ Includes Soviet Union 22, Aden 10.

Figures in million lbs. per annum for season August 1956 - July 1957, taken from Industrial Fibres, H.M.S.O., 1958.

Table 2

(B) Other Cotton Producing Countries

Country	Production	Home Consumption
Soviet Union	2,900	2,970*
China†	1,500	1,630
Spain†	105	220
Eastern Europe	50	*
Colombia†	50	79
Burma	50	—
Afghanistan	43	—
Korea	38	131
Paraguay	24	—
Guatemala	19	—
Italy†	18	422
Union of South Africa	16	24
Other countries	142	—
Total world production	18,752	—

* Eastern Europe included with Soviet Union.

† Also major importers—see (C).

Cotton Grading

The traditional method of grading cotton is the assessment of a sample from the bale by a cotton classer (Fig. 8). While this method is obviously open to personal error and depends greatly on the skill and experience of the cotton classer it is, nevertheless, a rapid and effective method.

(left) Fig. 9. Examining a cotton sample by hand.

(right) Fig. 10. The Pressley tester
(courtesy, National Cotton Council)

In order to maintain uniform standards of classing, organisations, such as the U.S. Department of Agriculture, in the producing countries supply standard samples of cotton over the whole range of classes. During training and subsequently with doubtful samples or as a periodical check, the classer compares the samples which he is examining with these standards. Cotton is graded according to:—

(1) Staple length.

(2) Colour.

(3) Amount of foreign matter, and quality of preparation.

The staple length is determined by a standard procedure of pulling a hand sample, and judging its length. U.S. standards for American Upland, American - Egyptian, and Sea Island cottons range in intervals of $\frac{1}{16}$ or $\frac{1}{32}$ in. from $\frac{3}{4}$ to $1\frac{3}{4}$ ins. The U.S. standards of colour for Upland cotton are white, gray, spotted, tinged, or yellow stained; and for foreign matter and preparation are good middling, strict middling, middling, strict low middling, low middling, strict good ordinary, and good ordinary. The assessment of foreign matter depends on how much leaf, small seeds, sand, and other dirt and trash are included in the sample. The quality of preparation, which is affected by the ginning, is determined by the uniformity and openness of the specimen. Poor grades of cotton contain many neps, also an appearance of roughness or stringiness.

The colour and grade are not treated as completely independent—more latitude in colour is allowed in the lower grades than in the higher. Only in the white class are all seven grades used—the lower grades are not separately classed for colour, and some more grayish, dingy, or slightly reddish cottons are allowed to count as white. In all, there are 11 grades which are counted as physical standards, and 13 which are used descriptively. The physical standards are distributed by the U.S. Department of Agriculture in boxes containing 12 samples covering the range of cottons, allowed within the grade, Fig. 8. Older standards, which are not now officially recognised, are the higher grades of middling fair and strict good middling, and extra white in colour.

For other types of United States cotton (e.g., long-staple Upland, and Sea Island cottons) and in other countries the jargon of cotton classing is different. For instance, in Egypt the grades are extra, fully-good, good, fully-good-fair, good-fair, fully-fair, and fair. The importance of cotton classing is two-fold: the price of cotton depends on the staple length and grade; and grading is the only means of supplying the spinner with the type of cotton that he wants. Cottons that do not fit into any of the standard grades, because they are mixed, excessively dirty, oil-stained, grassy, seedy, gin-cut, repacked, or otherwise out of the ordinary, are sold on the basis of special samples.

In addition to the staple length and class, there are other properties of cotton, such as fineness, strength, maturity, uniformity, drag, and body—all important to the buyer. These can be estimated by those skilled in the art from the appearance and feel of the sample as a tuft is pulled. In recent years, however, the tendency has been to replace these arbitrary assessments by physical tests which will give numerical values of cotton properties. There are two types of test in use. The most useful are those sufficiently simple, rapid, and cheap to be used as a routine technique on all samples of cotton. Where this is not possible, less rapid tests may be used as a check on personal judgment in case of doubt or dispute, or where more information is particularly required. The distribution of fibre length within a cotton sample may be found from the construction of a sorter diagram, laying out the fibres in order of length (see Fig. 1, "T.M.", Feb., page 127). This is a time-consuming operation, and the "Fibrograph" devised by Hertel uses photo-electric cells to do the job more rapidly.

Table 4

(C) Main Importing Countries

Country	Imports	Consumption
Japan	1,325	1,353
United Kingdom	728	750
Western Germany	639	684
France	625	657
Italy*	403	422
India†	250	2,151
Belgium	212	216
Canada	192	178
Netherlands	156	163
Hong Kong	111	111
Spain*	101	220
Switzerland	93	88
Portugal	88	95
China*	75	1,630
Sweden	58	68
Austria	53	53
United States†	47	4,119
Australia	42	43
Finland	33	35
Colombia*	27	79
Denmark	17	17
Norway	10	10
Consumption in other countries		465§
Total world consumption		18,695

*** Also major cotton producers—see (B).**

† Also major cotton exporters—see (A).

§ Includes Yugoslavia 96, Chile 43, Formosa 67.

The photo-electric stapler produced by Shirley Institute gives a value for the staple length. None of these methods is cheap enough for routine use, and, in practice, the classer's judgment of staple length is sound.

Fineness is now widely quoted in terms of micronaire values, obtained by measuring the resistance to the flow of air through a suitably prepared plug of cotton. Either the micronaire instrument or other instruments such as the W.I.R.A. fineness meter (cotton model) may be used, and calibrated with standard samples. The arbitrary micronaire scale can be related to the specific surface of the fibres. These tests can be carried out rapidly and used as routine tests. Maturity is less easily measured. Standard microscopic methods whereby the fibres are stained, sectioned, or swollen in caustic soda, are slow and laborious. There has been some progress in the use of air-flow methods to measure maturity—either by the use of two pressures on the plug of cotton, or by testing a sample swollen in caustic soda—but these are not yet widely used.

Strength tests on single fibres are also tedious and expensive, but test on cotton bundles can be made rapidly. The Pressley test (Fig. 10), while it can be criticised on fundamental grounds, showed how this could be done. More recently, it has been shown that it is sounder to clamp the bundle between jaws which are a few millimetres apart; and improved instruments such as the "Stelometer" and Clemson testers, which also give an indication of breaking extension, have been developed. The Pressley test gives an arbitrary index of strength, but it is possible to convert this to absolute values. The amount of foreign matter present can be found by the Shirley Analyzer.

As a result of the introduction of these tests, it is now possible to give indices of fineness and strength as regular information on marketed cotton. In special cases, the length distribution, maturity, and trash content can also be found. More complete reports on typical cottons of various types grown in different localities are issued by organisations such as the Shirley Institute and the U.S. Department of Agriculture. These give details of both fibre tests, and tests on yarn produced by small scale spinning processes. They can be used by the spinner in conjunction with the more limited details of particular consignments, to give him information on the expected behaviour of cotton which he is buying, on the best conditions for processing, and on the quality of the yarn to be spun. Small-scale spinning tests are also the only really satisfactory method of selecting cottons for breeding.

World Production and Trade

The United States is the largest grower and exporter of cotton, producing more than a third of the world's cotton. The other major producers are Russia, India, and China, followed by Mexico, Egypt, Pakistan, and Brazil. But, as can be seen from Tables 2, 3 and 4 there are now a large number of medium producers, and a wide distribution of trade. The United Kingdom imports its largest quantity of cotton from the U.S.A., with the Sudan and Nigeria coming next—in the previous year Nigeria came second. The growth of world production is shown in Table 5. In the years between 1951 and 1956, production exceeded consumption, and stocks of cotton grew—particularly U.S. Government stocks acquired by the Commodity Credit Corporation at guaranteed prices. However with the large export programme for surplus U.S. cotton, the position has been reversed, and stocks are falling.

Table 5. World Production of Cotton

Year	Production (million lbs. p.a.)
Average, 1934 - 39 ..	14,549
Average, 1946 - 51 ..	12,981
1952 - 53 ..	17,652
1954 - 55 ..	18,810
1956 - 57 ..	18,752

New Autumn Patterns

The influence of Paris is seen in this Autumn 1959 range of Courtaulds' fabrics shown on the facing page. This is instanced in the new colours—moss green, browns, dark evergreens, peat and earthenware red. Once again surface interest plays an important part; those shown include boucle finishes, textured surfaces and colour woven jacquard patterns.

(1) A5299. "Ski Club," 100% acetate, 6 ozs., 36 ins. wide. The gay design is inspired by Swedish peasant dress. Particularly suitable for evening skirts, etc., when in one of the broad pattern designs, or for light furnishings in a small, all-over design.

(2) A4878. 100% acetate, 6·53 ozs., 48 ins. wide. Colour woven faille with ribbed appearance. Available in thirteen colours, it is suitable for dress, skirts and suits.

(3) A5125. Moire, 100% acetate, 3·75 ozs., 36 ins. wide. Available in a wide colour range varying from pale turquoise to black this fabric is most suitable for cocktail and evening dresses.

(4) AF4896. 50% "Opaceta"/50% "Fibro," 7·34 ozs., 54 ins. wide. Small houndstooth check in seven colours—all with black. Crease resistant, it is excellent for dresses and skirts.

(5) YCF2482. "Visa," 50% "Courtelle"/50% "Fibro," 5·6 ozs., 36 ins. In colours ranging from white to navy blue and black, this fabric washes, drips dry and only requires a light iron.

(6) A5013. "Montaigne," 100% acetate, 5·67 ozs., 36 ins. Jacquard in mosaic and flower designs in a wide range of colours. Made with "Taslan," it is suitable for separates, dressing gowns or light furnishings.

(7) "Montaigne." 100% acetate, 5·67 ozs., 36 ins. Distinctive jacquard available in seven colours including dark jade green and olive green. Made with "Taslan."

(8) A4762. 100% acetate, 7·3 ozs., 48 ins. Colour woven satin available in eight colours; for evening dresses, etc.

(9) "Boccaro." 27% acetate/73% viscose mixture, 6·8 ozs., 36 ins. This boucle weave, in ten new Paris-inspired colours, is specially designed for suits and dresses.

(10) A5014. "Montaigne," 100% acetate, 5·67 ozs., 36 ins. Available in twelve colours—including turquoise and royal blue, this smart jacquard is eminently suitable for coats, suits, dresses or light furnishings.

Earthing Circuits and Tests

An efficient protective system will allow sufficient earth fault current to flow through the earthing system to operate the protective fuse or excess-current releases on a circuit breaker, but many earthing systems are not as efficient as they may appear from inspection

By "ENGINEER-IN-CHARGE"

THE neutral point of a polyphase a.c. supply system is normally connected to earth at the supply plant or transformer A as in Fig. 1, so that the neutral conductor, and all conductors which are directly connected to it, are substantially at earth potential. The phase-to-neutral voltage, having a standard value of 240 volts, exists between each phase conductor and neutral or earth.

In industrial premises considerations of mechanical protection usually demand that most of the cables be carried in steel conduit or have a metallic sheathing. In the event of an earth fault, or failure of insulation between a conductor and its metallic casing or sheathing, this casing, conduit or metallic sheathing becomes alive at a certain voltage to earth. When such an earth fault occurs it is essential that the current be cut off automatically and swiftly in order to avoid risk of electric shock to persons who may come into contact with metallic casings or sheathings. The current must also be cut off in order to avoid risk of fire which might occur if the voltage on the metalwork caused current to return to earth and the earthed neutral point through some unintended path, which might be a gas pipe.

The Earth-Fault Loop

The usual method of ensuring that the current is cut off in the event of an earth fault is by connecting the metal casings, conduits, cable sheathings, etc. solidly to earth by means of a substantial earth-continuity conductor and earthing lead, as required by Regulations. In Fig. 1 the earth-continuity conductor used to connect together the metal casings and to the earthing lead J is represented by the double lines H; in practice the metal cable sheathings or conduits usually act as the earth-continuity conductor.

When an earth fault occurs an efficient protective system will allow sufficient earth fault current to flow through the earthing system to operate the protective fuse or excess-current releases on a circuit-breaker. It would appear however, from the results of investigations into causes of fires, that many earthing systems are not as efficient as they may appear from inspection. Fig. 1 shows that when an earth fault occurs at a point G in a motor E the fault current must pass through one phase (B) of the supply plant, the phase conductor B_1, the excess-current release coils of the circuit-breaker F and motor starter D, the fuses in the distribution fuse box C, the fault G, the earth-continuity conductor H, consumers' earthing lead J, the consumer's earth electrode K, the general mass of earth L from K to the neutral-point earthing electrode M, and the neutral earthing lead N. This earthing circuit constitutes what is known as the earth-fault loop.

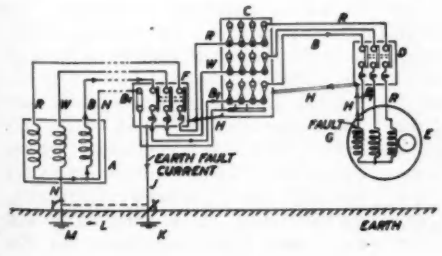


Fig. 1. Path of earth fault current in a 3-phase motor circuit

If the impedance of this earth-fault loop is not sufficiently low an earth fault may pass insufficient current to operate the protective fuse or circuit-breaker. The metallic casings and sheathings may then remain alive at a certain voltage to earth, with risk of electric shock and fire. If the impedance is high due to an earthing conductor being too small there may be a risk of this conductor fusing, whilst a considerable amount of heat may be generated at a faulty connection of the earth-continuity conductor or earthing lead, apart from the risk of arcing to an earthed gas pipe. It will be realised that arcing to a gas pipe may occur even though there is no direct contact between the earthing system and the gas pipe. Fires have resulted due to current passed from a faulty earthing system through structural steelwork to a gas pipe.

Metallic conduits and cable sheathings, earth-continuity conductors and earthing leads should be prevented from coming into contact with gas pipes. Where such separation is impracticable for any reason the metallic conduits etc. should be efficiently bonded to the gas pipe so as to avoid any possibility of arcing between them in the event of an earth fault. However it is, in any case, essential to maintain the protective system in operating condition.

Earth-Fault Loop Impedance

In order to ensure that the impedance of the earthing system is sufficiently low it should be tested periodically. The Regulations for the Electrical Equipment of Buildings, issued by The Institution of Electrical Engineers, require that the impedance of the earth-fault loop be tested by injecting current through the loop. Where solid earthing, with fuses or excess-current releases on circuit-

breakers, is relied upon for earth-fault protection the impedance of the earth-fault loop shall be sufficiently low that, on the occurrence of a fault of negligible impedance from a phase or non-earthed conductor to adjacent exposed metal, a current corresponding to three times the current rating of the protective fuse, or 1½ times the excess-current setting of the circuit-breaker, can flow to make the circuit dead. This means that the impedance of the earth-fault loop must not exceed

$$\text{the value} \frac{\text{Phase-to-neutral voltage}}{3 \times \text{current rating of fuse,}} \text{ or}$$

not more than the value

$$\frac{\text{Phase-to-neutral voltage}}{1\frac{1}{2} \times \text{excess-current setting of circuit-breaker}}$$

Column 4 of Table 1 gives the maximum earth-fault loop impedances for circuits of various ratings protected by fuses or circuit breakers, on a supply with 240 volts between phase and neutral. The permissible earth-fault loop impedance is proportional to the phase-to-neutral voltage of the supply. It will be noted that a much lower impedance is required on high-current circuits than on circuits of lower rating. For instance the impedance of the earth-fault loop to the distribution fuse box C in Fig. 1 must be low enough to operate the excess-current releases of the circuit-breaker F. The impedance of the earth-fault loop to the motor starter D must be low enough to operate the fuse in C. The impedance of the earth-fault loop to the motor E need only be low enough to operate the excess-current release of the starter D, although it is advisable to keep the impedances as low as possible.

Test sets have been designed in which the testing current is passed between the neutral conductor and the earthed metalwork, instead of between a phase conductor and the exposed metal. However the results obtained by such sets are liable to be rather inaccurate due to volt drop in the neutral conductor caused by out-of balance current passing along this conductor.

Measurement of Earth-Fault Loop Impedance

Fig. 2 shows the connections of an interesting phase-earth loop impedance tester. With the switch A on the contact B the set may be used to measure the earth-fault loop impedance to the socket-outlet shown. With the switch A on the contact C the set may be used to measure the earth-fault loop impedance between the phase-conductor connected to L and exposed metalwork to which the clip D is secured. When the push button F is pressed the phase conductor L is connected to the earth socket of the socket-outlet, or the exposed metalwork, through the resistor G and the circuit-breaker H. Before using F the neon lamp M should be noted to make sure that the socket-outlet is correctly connected. When F is pressed the volt drop across G is rectified by P and charges the capacitor Q to the peak value of the volt drop across G. The circuit I and J causes the coil K to trip the breaker H to cut off the artificial earth-fault current before the circuit fuse can operate.

The capacitance of Q is sufficient to maintain the reading on the instrument R for a short period. By referring the reading on R to a curve the earth-fault loop impedance is obtained with a reasonable degree of accuracy. After taking the reading the capacitor Q may be discharged by pressing the push button switch S.

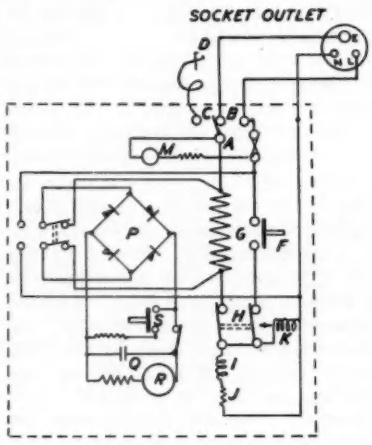


Fig. 2. Connections of a phase-earth loop impedance tester

Tests Required at Various Points

It is not really sufficient merely to test the earth-fault loop impedance at the service point and at the end of each sub circuit. Referring to Fig. 1 it is possible that the earth-fault loop impedance at the motor E may be low enough to operate the trips in the starter D, and the impedance at C to be low enough to operate the trips in the main breaker F, without the earth fault loop impedance to the starter D being low enough to melt the fuse in C. Thus tests should be made at the end of each section fed through a protective device, i.e. between the conductors and metalwork at C, D and E. Tests should also be made on any metalwork connected by means of a branching earth-continuity conductor. The I.E.E. Regulations also require that the impedance of the earth-continuity conductor, when measured with current at supply frequency, shall not exceed one ohm from the consumer's earth electrode to any point on the exposed metalwork, whilst lower values are required on circuits of high current rating. The difference between the earth-fault loop impedance values measured at F and E may be taken as the impedance of the earth-continuity conductor between F and E, neglecting the phase conductor between them. The instrument indicated in Fig. 2 is very useful for checking the latter values since it actually measures the earth-fault loop impedance.

Testing the Fault Current Rating of the Earth-Fault Loop

The instrument indicated in Fig. 3, whilst it does not actually measure the earth-fault loop impedance, can be used to verify that this is low enough to operate the protective fuse or circuit breaker. The tester is connected between a phase conductor L and the exposed metal E, the fuse rating selector switch being set at a suitable value to correspond with the rating of the circuit fuse, or the over-current setting of the breaker. The normal range of this switch is 15, 30, 40 and 60 amps., but additional ratings of 75, 100 and 150 amps. are obtainable. The test set can be used even if the neutral point of the supply is not available.

Various safeguards are incorporated. In the first position of the selector switch a check lamp is connected between the phase and earth-continuity conductors when the operating switch is pressed. This should be used at the commencement of each test to ensure that the earth-continuity conductor is actually connected to earth, and should be used after the test to ensure that the earth-continuity conductor has not been fused by the high testing current.

After setting the fuse rating selector switch the operating switch is pressed, and the coils of two miniature circuit-breakers in the set are energised to connect the phase conductor to the exposed metalwork through the selected resistor. The artificial earth-fault current which then flows through the earth-fault loop is limited by the resistor, and the time-delay relay then opens the breakers in 1½ cycles, i.e. before the circuit protective devices can operate. If the voltage across the selected resistor reaches a certain value, corresponding to a sufficiently low earth-fault loop impedance for the

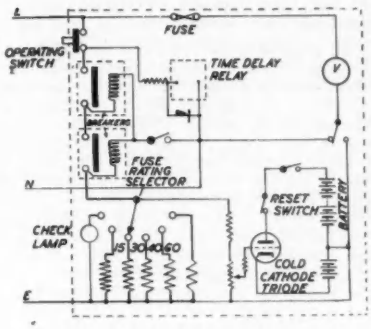


Fig. 3. Connections of a Ferranti phase-earth loop tester

selected fuse rating, the cold cathode triode valve will glow, and will continue to do so until the reset switch is operated by hand.

Differential Earth-Leakage Trips

In some high-current installations difficulty may be experienced in obtaining a sufficiently low earth-fault loop impedance at the metal casings of the second excess-current protective device to operate the first excess-current device. This is often due to the consumer's earth electrode, shown at K in Fig. 1 having a high resistance, but is sometimes due to the neutral-point earthing electrode M having a high resistance. This particular difficulty does not arise in cases where the exposed metalwork of the consumer's installation is connected to the earthed neutral point of the supply directly, as by the conductor X-Y shown dotted in Fig. 1. In these circumstances earth-fault current to earthed casings or sheathings does not have to pass through the earth.

A solution to the difficulty of maintaining an earthing electrode of low resistance, as required for high-current circuits is to install a differential (current-balance) earth-leakage trip on the main or high-current circuits. The I.E.E. Regulations require that where these are fitted they should open the controlled circuit-breaker in the event of earth leakage current not more than 15% of the rated current of the circuit or 5 amps., whichever is the greater, as shown in column 6 of Table 1. Column 5 gives the maximum permissible earth-fault loop impedances which will provide this protection on a circuit operating at 240 volts between phase and neutral, with a safety factor of 1½. It will be seen that this system of protection remains operative on much higher earth-fault loop impedances than where earth-fault protection is solely by fuses or excess-current releases, as will be seen by comparing columns 4 and 5.

Fig. 4 shows the connections of one such current-balance earth-leakage trip. With sound insulation the current which passes to the plant through one or two conductors, as R and W, returns through the other conductors or conductor B. These load currents induce proportionate currents in the secondary windings of the current transformers. Under sound conditions the algebraic sum of the load currents, and the secondary currents, at any instant is zero. No current then flows through the leakage trip coil or relay. However in the event of an earth fault the fault current in the circuit conductors returns to the earthed neutral point through the earth-continuity conductor instead of through the other line conductor or conductors. There will then be a resultant current in the secondary windings which will pass through the leakage trip coil or relay to trip the circuit-breaker.

Earthing Circuit Faults

In the event of the earth-fault loop impedance on sub-circuits being too high this can usually be rectified by overhaul of the earth-continuity conductors, if the impedance of the earth-fault loop of the main circuits is satisfactory. It may be that an earthing conductor has become loose or been disconnected, that conduits or cable sheathings are loose at metal casings, or that the enamel has not been properly cleaned from conduits and casings at the point of contact. In case of difficulty it is advisable to bond across faulty joints or connections by means of a substantial copper conductor. It is, of course, necessary to bond across any flexible conduits.

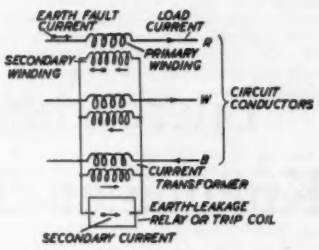


Fig. 4. Connections of a 3-phase earth-leakage protection system operating on the current-balance system

No earthing conductor (other than one contained in a composite cable) should be less than 0·0045 sq. in. (7/0·029). In all circuits where the cross-sectional area of the current-carrying conductors is between 0·0045 sq. in. (7/0·029) and 0·2 sq. in. (37/0·083), the cross-sectional area of the earth-continuity conductor should not be less than half that of the current-carrying conductors, subject to a minimum of 0·0045 sq. in. (7/0·029). Where the current-carrying conductors exceed 0·2 sq. in. (37/0·083 sq. in.) the cross-sectional area of the earth-continuity conductor should not be less than 0·1 sq. in. (19/0·083). Earthing conductors should be run as straight as possible and by the shortest practicable route, if they are not drawn into conduits. They should never be coiled into a spiral, however neat, as this may create a substantial magnetic field when fault current flows, thus increasing the impedance.

High impedance may occur in a long run of screwed conduit having many joints, if worn dies have been used to cut the threads or if the joints have not been pulled up tight. A slack joint may have a low impedance when clean and new, but may develop a high impedance in time due to moisture causing corrosion, or vibration causing slight relative movement of the joint. The best type of connection between screwed conduit and a metallic casing is obtained by screwing the conduit into a tapped hole in the casing and locking it in position.

Table 1
Satisfactory Earthing Conditions for an a.c. Circuit Operating with 240 volts between Phase and Neutral

1 Current rating of fuse (amps.)	2 Approx. size of tinned-copper fuse wire (s.w.g.)	3 Over-current setting of circuit-breaker (amps.)	4 Maximum permissible impedance of earth-fault loop (ohms) with excess-current earth-fault protection on a 240 v. circuit	5 Maximum permissible impedance of earth-fault loop (ohms) with current-balance earth-leakage protection on a 240 v. circuit	6 Maximum permissible earth-leakage current (amps.)
5	35	10	16	32	5
10	29	20	8	32	5
15	25	30	5·3	32	5
20	23	40	4	32	5
30	21	60	2·7	32	5
40	19	80	2	26·7	6
60	17	120	1·33	17·8	9
80	15	160	1	13·3	12
100	14	200	0·8	10·7	15
125	—	250	0·64	8·6	18·7
150	—	300	0·53	7·1	22·5
175	—	350	0·46	6·1	26·2
200	—	400	0·4	5·3	30
300	—	600	0·27	3·5	45
400	—	800	0·2	2·7	60

Nottingham Textile Society

Encroachment of Warp Knitting on the Other Textile Industries*

By D. F. PALING†

THE growth and development of the warp knitting industry has been very largely related to the development of continuous filament yarns. It would, in fact, be true to say that the warp knitting industry would not have assumed its present size and importance if it had not been for the development of continuous filament rayon and synthetic yarns. The second major period of expansion and development has occurred during the last 12 years, and it is during this period that the industry has begun seriously to encroach on the markets previously supplied by other industries.

Curtain nets have been produced by the warp knitting process for many years, but it is not until recent years that the total output has constituted any threat to, or encroachment on the other textile trades concerned with their production. Large quantities of "Terylene" and viscose plain nets are now being produced on two-bar F.N.F. machines and on bearded needle machines which have been specially developed with split sinkers, for this purpose. In general a somewhat coarser gauge than the standard 28-gauge is preferred, partly for the appearance of the ultimate net and partly for economic reasons, and machines with 21 or 22 needles per inch are most popular for the purpose. There are numerous variations of the construction used for curtain nets on these machines but most employ two full sets of warp threads of which the front set usually knits a straight pillar stitch and the back set performs laying-in actions to connect together the pillar produced by the front guide bar, at selected intervals.

In the most common constructions the in-lay threads combine with the knitted pillars to produce a square-mesh marquisette net. It is usual to strengthen the selvedges of the net by threading the inlay bar with two threads per guide in these areas for a width of about ½ in. It is also common practice to provide a detachable selvedge on each side of the net which can be pinned into during the stenter setting and dressing of the net. This detachable selvedge is usually about ½ or ¾ ins. in width, and is connected to the main net by two ends of 15-den. monofilament nylon carried in one guide of the inlay bar. This double thread is strong enough to stand up to the tensions developed during heat setting and dressing but can readily be ripped at a later stage to allow the selvedge to be detached, leaving a clean edge to the actual net which has not been damaged by the stenter fins.

At one stage, warp knitted curtain nets fell into disrepute because of wale slippage which gives rise to distortions and imperfections in the finished product. This fault, is however, mainly limited to the cheaper products in which the inlay bar is moved across only two needle spaces during the connecting underlap, or in which the knitted quality in terms of courses per inch does not provide sufficient cohesion between the pillar and inlay threads. A two bar knitted curtain net in which the inlay threads are moved across a minimum of three and preferably four needle spaces and which is also knitted at a reasonable quality does not exhibit this defect and will stand up to repeated laundering without any movement of the ground construction. A three bar construction is, however, desirable in this respect as the opposed motions of the two inlay bars makes wale slippage virtually impossible irrespective of the quality of the construction, and for this reason the three Bar F.N.F. machine and three and four bar bearded needle machines with split sinker are now finding a larger market.

Apart from the tremendous volume of plain curtain net now being produced on F.N.F. and bearded needle machines, a further encroachment into the markets of the lace curtain industry has been made by the Raschel product. With the larger number of guide bars available it is possible on these machines to produce curtain nets on a perfectly stable three-bar ground, while leaving additional bars for the introduction of pattern. Basically two distinct products are at present commanding large markets and the demand far exceeds the productive capacity available. Five-bar all-over nets in which three fully threaded bars are used for the ground and two partly threaded bars are used for the introduction of pattern form one of the large markets.

Insertion type nets or brise bris form yet another large market which has been recently developed. These nets are made with the usual three-bar ground which is produced in sections across the width of the machine, while the intermediate sections are produced with the front pillar bar in conjunction with patterning bars which connect the pillars together in varying groups and at varying intervals in order to produce panels of open-work design. Other guide bars are used to produce the lower edge of the net and also the hemming lines on the opposite edge. For this type of net it is usual to employ 12-bar machines. Raschel machines have in fact been specially developed for the production of curtain nets.

In general, these machines are designed to run at much higher speeds than the established lace machines and this increase in speed is achieved partly by using a shorter hook needle which reduces the needle bar stroke. It is also usual to provide accommodation for 21 ins. dia. flange beams in the three-front beam positions from which the ground is knitted, these three beams being positively driven as distinct from the brake let-off provided on the lace Raschel machines. The patterning threads may be supplied from a creel in preference to warping them in the conventional manner, and in general it is possible on these machines to obtain extremely high production speeds coupled with very good machine efficiency. Machines are also available in widths up to 240 ins., making possible the concurrent knitting of a variety of curtain net widths.

Sheets

Another recent development which has encroached seriously on the Lancashire trade has been the introduction of fitted nylon and "Terylene" bed sheets and pillow cases. For this purpose a reasonably stable construction is preferred, although a very slight extensibility is desired to ensure a perfect fit of the bottom sheet to the mattress which may vary slightly in dimensions from one manufacturer to another. The reverse locknit construction has in general proved to be the most satisfactory from this point of view and is the most common construction for this purpose. It has also been found desirable where possible to make up the sheets with the width of the fabric running in a length direction of the bed. Thus, wide fabrics in the region of 96 ins. width are preferred, to give in one single piece without seams, except at the corners, a fitted sheet which extends over the length, width, and depth of the mattress together with sufficient material on the underside of the mattress to provide an effective means of holding the lower sheet securely in position.

Sheets are being made particularly in 40-den. dull nylon and also in 40-den. "Terylene," while candy stripe sheets in two colours are also in demand at the present time. These are usually made in alternate stripes of 40-den. nylon and "Terylene" of which the nylon is subsequently dyed and the "Terylene" reserved. Brushed 30-den. nylon reversible bed sheets are also finding much popularity at the moment, pillow cases, generally in the same basic fabric as the fitted sheets are decorated with embroidery, applique lace, lace edgings, pleated frills, etc., and the excellent methods of packaging and presentation has done much to establish these new products in a market almost completely reserved to the weaving trade previously.

This development has not been without its problems to the warp knitter, because the large area of fabric required for a single sheet, has imposed very strict requirements of quality in terms of freedom from faults, in fabric which is of necessity made on machines 144 or 168 ins. wide. Warp knitted shirting fabrics have, during recent years, established themselves very firmly in so far as synthetic materials are concerned, and the demand of the general public seems to be either for a woven poplin garment or alternatively for a nylon or "Terylene" warp knitted

* *From a paper given recently to Nottingham Textile Society.*

† *Jersey Fabrics Ltd., Nottingham.*

garment. The woven synthetic shirt has not been so readily accepted by the public as its warp knitted counterpart. A variety of fabric constructions has been used for the purpose including reverse locknit, sharkskin, queen's cord, i.e. a two-bar fabric with a pillar stitch on the front bar, combined with a three or four-needle shog on the back bar. Early objections to fraying or "pilling" particularly at the cuffs and collars have now been overcome by improvements in fabric constructions, improvements in finishing techniques and by the use of more highly twisted yarns. All the fabric constructions employed for the purpose are of a stable or semi-stable nature and there now appears to be a little doubt that the warp knitted shirt has become firmly established.

Very recently the warp knitting industry has made great advances in the outerwear trade and although the industry has been firmly established in this trade for very many years, the recent developments have been on a much larger scale and have made encroachment particularly on the weft knitting industry. The major development in this sphere has undoubtedly been in the production of the so-called "loop-raised" fabric in which chiefly low-twist nylon yarns, particularly 30 den., have been employed. The fabric construction used for this purpose is by no means new in itself, and usually involves the guide bar notions already well established for the production of brushed fabrics in general.

These constructions involve the use of two full sets of warps, the back one of which makes a one and one lapping movement, and the front guide bar a three and one lapping movement, in the same direction. This construction gives the ideal conditions necessary in the brushing or loop raising operation during which the threads supplied by the front guide bar are required to be raised from the ground of the fabric to develop a looped pile without involving the breakage of filaments. The construction mentioned permits the necessary width contraction of the fabric which is of course essential to supply the yarn required for the looped pile by permitting yarn movement within the construction itself. It is also possible for the card clothing of the pile and counter pile rollers of the raising machine to penetrate the construction and operate on the filaments of the front bar threads without in any way interfering with the back bar threads, thereby permitting not only a uniform unbroken pile on the one side of the fabric, but also a clean and undistorted face on the opposite side.

This development, although based on a warp knitted fabric construction, has, however, been made possible by the efforts of the finisher and a great deal of research has gone into the establishing of the process, especially in determining the ideal sequence of operations, and whether to brush the fabric in the grey as a preliminary operation, or whether to scour and pre-dress the fabric before raising, or whether to delay the operation until after heat-setting. The results of these developments has produced a fabric ideally suited to the manufacture of outerwear garments, and in lighter constructions a fabric suitable also for underwear. Garments made in "looped-raised" fabric, currently enjoying great popularity include ladies' jumpers, cardigans, twin-sets, dressing gowns, nightdresses and children's outerwear garments, and it is almost certain that this encroachment on the markets of the equivalent fully-fashioned and cut garments will remain a serious threat for some time because of the sheer attractiveness of the garments and the quick drying properties they possess.

Trimmings

Another warp knitting development which has taken place during the last four years has been in the production of trimmings, or so called "angel laces," on two bar, three bar and four bar bearded needle machines. These products vary so widely in their appearance and application that it is difficult to say precisely which other products have suffered as a result of their development. The majority of angel laces are, however, used as trimmings for underwear and lingerie, and it is therefore reasonable to assume that their development has been at the expense of lace, embroidery, flock printing, pleating, narrow fabric or some other form of decorative trimming which would have been used in the absence of their development.

The simplest types of angel lace are produced on two-bar machines but this does not imply that they are by any means plain or simple constructions. In fact very attractive trimmings can be produced on two-bar machines by making use of long pattern chains to give elaborately scalloped products, which, combined with areas of full and part set threading in the two bars, enables areas of solid fabric and open mesh to be combined to give many attractive variations. These features are further enhanced by the use of pre-dyed yarns or alternatively the selection of yarns capable of being cross dyed in the finishing process. The usual constructions are made in nylon yarns, while heavier viscose rayon effect threads are used to introduce additional pattern effect, and it is usual during the dyeing operation to colour one of the component yarns and leave the other white. The appearance of these trimmings is frequently further enhanced by subsequent flat pleating or crystal pleating.

The principle of producing trimmings on warp knitting machines is dependent upon the construction being designed so that the separate trimmings are joined to each other at the knitting stage by narrow strips of fabric composed of cellulose acetate rayon. If the trimming is in the form of a straight ribbon then a single cellulose acetate thread carried in a bar performing a 1-0/1-2 lapping motion will be sufficient to hold the component bands together during the setting and dyeing and finishing operations. If, however, the trimming features a scalloped edge which involves traversing the guide bars it may be found necessary to introduce two or three acetate threads to give the essential conditions necessary to permit the component bands to be separated from each other, when as a final operation, the pieces are immersed in acetate to dissolve away the cellulose acetate components.

When producing scalloped trimmings by this method it is obviously necessary for the two edges of the trimming to follow each other precisely. It is also desirable for the two guide bars to move in opposition to each other at every course in order to produce reasonably straight wales in the areas of solid fabric. These two apparently conflicting requirements are fulfilled by causing each bar to change direction at each course and any traversing movement is obtained by moving the front guide bar for instance two right, one left, two right, one left, etc., while at the same time the back guide bar would be moving one left, two right, one left, two right, etc. These movements result in the guide bars moving always in the same general direction, although in any given course they are always moving in opposition.

The use of three-bar machines for the production of trimmings gives the designer an additional degree of freedom which may be utilised in several ways. It will be appreciated from the constructional details just given, that the pattern effect in two-bar trimmings must inevitably follow the general traverse of the two bars employed and will therefore remain parallel at all times to the two selvedges. The use of a third bar provides means of breaking this monotony by the introduction of pattern threads which do not follow the same essential path as the selvedges, but which may be caused to run in complete opposition to the ground bars, or used in any way thought necessary to improve the pattern effect. Alternatively the third guide bar may be used to develop raised effects in the trimming. If used for this purpose the third guide bar is usually used in the front position and by a process of lapping and mislapping can be caused to raise the ground construction in the form of broken or continuous flutes or pleats, or alternatively if traversed while knitting and caused to mislap in a static position relative to the length of the needle bar, raised shell-like effects are obtained. If allowed to traverse while mislapping the front bar will introduce zig-zag effects into the ground construction especially if this is knitted as narrow strips which are dependent upon the front bar threads for their inter-connection. The third guide bar, if used in the middle or back position may be employed to introduce in-lay threads for connecting groups of wales knitted by the other two bars, or for creating additional effects of distortion on more solid constructions. Four-bar machines for this purpose offer even greater patterning facilities but have not so far been greatly developed.

The development of what may be called "Three Dimensional Fabrics," by causing one or more guide bars on a three or four-bar bearded needle machine to lap and mislap while stopping the run-in of the appropriate warps during the mislapping cycle, has produced a variety of fabrics ideally suited to the blouse and glove trades. Warp knitted blouses or rather garments more akin to light-weight jumpers have recently enjoyed great popularity. This has been partly due to the suitability of the basic fabrics produced but has also been made possible by the development of warp knitted fluting, which when used as a folded hem at the waist, sleeves and neck, extremities of the garment, provides the equivalent of a weft knitted rib with similar appearance and characteristics. Fluting for this purpose is usually made in monofilament nylon yarn with a threading of five in, one out, one in, one out, in each of the two guide bars employed. The lapping movement is a simple Atlas Travers repeating on four courses and made in opposition by the two guide bars. The fluting is knitted at the full 84-in. machine width when it materialises as a flat fabric showing alternate narrow panels of solid and open-work construction. This construction is relayed by pulling through boiling water during finishing, and the natural tendency of the solid areas to curl

produces a corrugated fabric of much smaller width, which is finally dressed at a width somewhere between 20 in. and 30 in. The resulting fluting shows an extensibility of 100% with almost immediate recovery, making it ideal for use in the manner already prescribed.

Ladies' Hose

One of the most recent warp knitting developments, which may prove to be one of the most serious encroachments on another industry, is of course that related to the production of ladies' hose from warp knitted fabric. This is a very recent development, and its full impact has yet to be realised. It is possible that it may have very serious repercussions on both the fully fashioned and seamless hose markets, or alternatively if the product is not accepted by the general public then it may very quickly come to nothing or remain only as a minor irritation to the stocking manufacturer. The unknown factor of customer acceptance of the product has yet to establish the size to which this new industry will expand and the importance it will assume. Stockings made from warp knitted fabrics are by no means new, as stockings made particularly from pure silk Milanese fabric were on the market very many years ago and more recently attempts have been made to produce and market stockings cut from 15 den. nylon locknit fabric. The latter, however, were not accepted because of the lack of the traditional high-heel splicing but this deficiency is eliminated in the latest development.

Special machinery for the production of warp knitted stockings was originally developed by Messrs. Ernest Saupe before the last war, but the product did not at that time establish itself because it did not fulfill the demands made by the public in respect of sheerness and appearance. The advantage of the warp knitted stocking being ladder-proof was not sufficient, since more value was placed on aesthetic appearance than on serviceability. This was due to the fact that the yarns available at that time (mostly 55 or 60 den. rayon) did not permit the production of a fabric as fine and delicate as that made on the fully fashioned or seamless hose machines. The locknit construction which provides the desirable ladder-proof qualities requires the knitting of two yarns into each stitch at each course and therefore when using the comparatively heavy rayon yarns produced a fabric which was almost opaque and completely unsuited to the current fashion requirements. Demand for the product was therefore so small that large-scale production on an economical basis could not be entered into, and the warp knitted stocking disappeared from the market.

The availability of 15 den. or 10 den. monofilament nylon yarn has, however, made it possible to produce a stocking which eliminates all the previous objections and disadvantages connected with the locknit construction. Although it is not possible to compare directly a 15 den. fully fashioned stocking with a 15 den. warp knitted stocking because of the presence of the two yarns within each stitch of the panel in the latter. It has been possible, nevertheless, to produce an article which is definitely in keeping with fashion requirements and which in wear is certainly comparable in appearance with its weft-knitted equivalents. This may, on the face of it, appear to be a contradiction in terms, but the very great difference in construction between the two basic fabrics employed must be taken into account in making the comparison. It is in fact possible for a warp knitted fabric to be produced on a very much coarser gauge machine than is used for the fully-fashioned product, without encountering the objectionable features which would arise if the same gauge was employed for weft knitting. The warp knitting machine developed for the production of stockings is in fact 26 gauge Saxon, i.e. 28 gauge English and therefore contains only 28 needles per inch, but nevertheless the fabric produced on this machine does not show the undesirable prominence of wales which would result from a similar gauge weft knitting machine. This is due to the fact that the wales in a plain weft knitted construction are connected by single threads or sinker-loops at each course, whereas the warp knitted locknit construction has two such connecting threads, one of which passes diagonally from one wale to the next while the other moves diagonally in the opposite direction from one wale to the next but one, thereby providing at each course an additional length of yarn which lies immediately at the back of each stitch. This disposition of the yarn within the construction permits the use of coarser gauge machines working at a much slacker quality than is permissible in the weft knitted equivalent while producing a fabric similar in weight per unit area, although using effectively double the weight of yarn. The fact that the fabric can be knitted very much slacker than would be desirable for the usual locknit construction used for lingerie purposes, also introduces into the construction adequate extensibility, even comparable with that of a fully-fashioned or seamless stocking.

During the last three years the warp knitted stocking has been growing in popularity throughout the world, and although only recently introduced to this country the stocking is already well established abroad, especially in Japan, where a considerable percentage of the stocking production is now warp knitted. The new warp knitting machine the Liba-Tibiale which is now used in the production of warp knitted stockings, incorporates many advantages over its forerunners which are designed to simplify and speed the manufacturing process. The machine has fully automatic warp let-off motions, a built-in pantograph, and automatic speed regulation, all of which are fully patented. The warping operation is in no way different from that employed for other warp knitting processes but should be conducted with the same care and precision and should involve minimum and uniform yarn tension, particularly at the creel.

The knitting machine is equipped with two normal full-set guide bars and a third bar mounted in the front position on the machine which consists of two sections. The back and middle guide bars are fully threaded and continuously make normal locknit lapping motions. The two sections of the front guide bar make similar lapping movements (actually a 1-0/1-2 motion), when knitting on the same group of needles, but move in exact opposition to each other when traversing. The two sections of the front guide bar supply the reinforcement or splicing for the heel, sole and toe and operate only intermittently, i.e., from the start of the high-heel splicing to the end of the toe, after which the front guide bar assembly remains stationary, and its threads lie loosely on top of the fabric. All movements of the front guide bar as well as the speed regulation are controlled from a timing chain similar to that used on Cotton's patent machines. The running speed of the machine is reduced during the period that the spliced areas are being knitted, i.e. when the front guide bar assembly is in operation, and is increased again automatically by the presence of a stud on the timing chain when the splicing is finished and the front guide bar assembly becomes inactive. In order to achieve maximum working efficiency the two running speeds can be adjusted independently of each other. The shape of the spliced areas is adjustable within the contour of the stocking by altering the arrangement of the timing chain and can therefore be changed accordingly to fashion trends, and the size of the stocking is similarly controlled by the same chain. The outline of the stocking is marked automatically on to the fabric during the knitting process, by means of pneumatically controlled pencils operated from a pantograph situated at the end of the machine.

The production of a 162 ins. Saxon (i.e. 150 ins. English) machine which knits simultaneously eight stocking sections, is approximately four dozen per hour.

The sequence of knitting is as follows:

1. Change from three guide bar to two guide bar operation.
2. Knit plain locknit fabric for the welt, thigh and calf. (During this period the two sections of the front guide bar are moved outwards without lapping to position themselves ready for the start of the high-heel splicing.
3. Introduce front guide bar assembly and knit the ankle, heel, sole and toe.

(During this time two sections of the front guide bar work straight for the high-heel splicing, move progressively inwards for the heel, move progressively outwards at the start of the sole, maintain the same narrow spliced area within the contour of the stocking for the sole, move progressively inwards for the toe until the centre threads meet and form an uninterrupted spliced area across the whole width of the toe which is maintained for the length of the toe.)

When a sufficient length of fabric has been knitted, the work roller is removed from the machine and replaced by an empty roller. The full roller is mounted in suitable supports and the fabric is pulled over a table during which operation the surplus splicing threads running from the toe of the stocking to the heel of the next one are removed, preferably by a splicing cutting machine.

To avoid loop distortion and unnecessary creasing it is recommended that the fabric should be pre-boarded as soon as possible after the knitting operation. For this process the fabric may be broken down into any convenient width by removal of one or more draw-threads which are incorporated in a warp direction during the knitting process (by leaving two adjacent middle bar guides empty at the appropriate places) the pre-boarding stabilises the loops in position, decreases the tendency of the fabric to curl and thereby makes the ultimate sewing process much easier.

Aerial view of Chemstrand's new "Acrilan" plant at Coleraine, Northern Ireland

The Chemstrand Plant at Coleraine

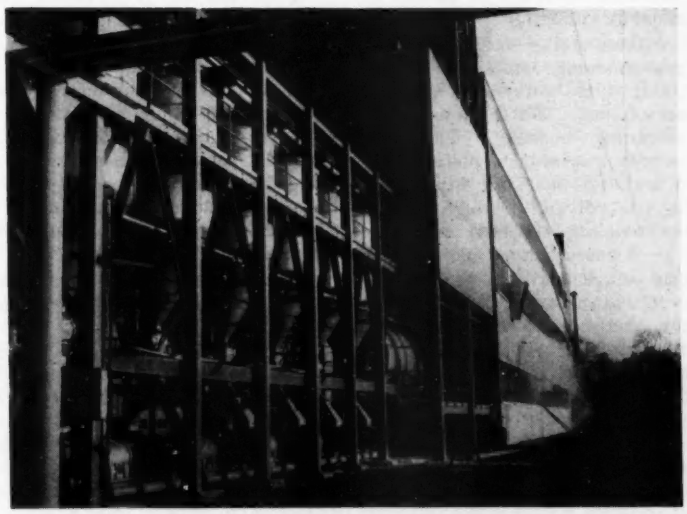
Designed to produce 10,000,000 *lbs. of "Acrilan" a year this new plant has been constructed in just over two years at a cost exceeding* £3,500,000

THE new "Acrilan" plant of Chemstrand Ltd., at Coleraine, N. Ireland, is designed to produce 10 million lbs. of fibre a year and will be in full production in the next few months. Design and construction of the plant took a little over two years at a cost of £3½ million though some of this cost will be covered by a government grant in an effort to solve local unemployment—a local reporter quoted a figure of one in ten of the nationally insured workers as being unemployed. The plant itself will employ about 400 people but it is hoped other associated textile industries will spring up and provide more employment.

Mr. C. H. Goodwin, project manager of Chemstrand Ltd., who has supervised the design and construction of the plant must be congratulated on his really excellent work. The plant is also a fine testimonial to the efforts of British chemical engineers for the main contractors were Constructors John Brown Ltd., and most of the sub-contractors were British; for example, much of the equipment in the fibre making and chemical sections was made by Baker Perkins Ltd.

At present, the acrylonitrile—the main raw material for the production of "Acrilan"—is brought to Coleraine harbour in tankers and is supplied by Monsanto Chemical Co., U.S.A. Later on it is expected that the acrylonitrile will be supplied by a British plant. The acylonitrile is pumped from Coleraine harbour direct to storage tanks within the plant area and from these it is fed to the polymer building where it is polymerised with other chemicals using an unspecified catalyst, in an unspecified solvent. Although the other chemicals are unspecified—for obvious reasons—one feels that acrylonitrile may be co-polymerised with vinylpyridine to promote the take-up of acid dyes.

Polymerisation takes place under closely controlled conditions at atmospheric pressure at a temperature of 130°F. and lasts about 75 mins. The polymer, along with unreacted monomer and catalyst, flows into a reactor hold tank where the catalytic action is stopped by an inhibitor. A rotary drum filter next removes most of the water and unreacted material from the



In the polymer building, pictured above, the main raw material—acrylonitrile—is mixed with other chemicals and catalysts to form a powdered polymer for blending with solvent to form the spinning solution

View of carding, spinning, winding, etc., section where samples of fibre are processed by similar machines to those used in British mills. This is one facet of a quality control system extending throughout manufacturing processes

slurry. The resultant polymer is now washed and passed to a reslurry tank from where it is filtered a second time.

The filtered polymer is forced into pellets to facilitate easier drying and carried on a conveyor belt through an oven to dry. After drying, the pellets, crushed into powder, are fed into storage tanks each standing on its own weight scale.

The above stages are carried out under carefully controlled conditions to ensure the polymer has the correct chain length and the right moisture content. This latter point is extremely important and the only way that variations in moisture content can be corrected is to mix polymer batches of high moisture content with batches of low moisture content.

From these storage tanks the polymer goes to storage tanks at the top of the 100 ft. high tower—an arresting feature of the 1,200 ft. long main manufacturing building. The next stage of the process takes place in this tower and this consists of gravity feeding the polymer through a continuous weighing machine manufactured by Richard Simon and Sons to a mixing tank where the polymer meets a solvent formed by the catalysed reaction between acetic acid and dimethyl amine. A suspension of titanium dioxide is added to this mixture of solvent and polymer so there will be no sheen on the finished product. The mixture, in the form of a slurry, is led into a Baker Perkins reactor where high temperature and violent agitation turn it into a solution or dope. The dope is subsequently cooled and passed through a de-aerating tank and a Johnson continuous filter press to a "spin" tank. Filtration is a very important technique in that any solid particles not removed would inevitably block-up the extrusion holes in subsequent stages of the production.

The dope is extruded through spinnerettes into a long bath or cascade. In this, the water flows in the opposite direction to the fine polymer filaments which are carried along by rollers revolving at different speeds to give the filaments a permanent stretch. From this cascade—which removes the solvent—the tow of filaments passes through a soft finish bath and is then roughly crimped.

The tow is next permanently crimpled and cut into correct staple lengths by a Beira centrifugal cutter which can provide staple of varying lengths depending on its speed at which it revolves. This very ingenious machine does not cut until it is revolving at the required speed, i.e., it will not cut when it is starting-up or stopping. Baling and packing is done by a machine manufactured by the Continental Gin Co., and the fibre is then ready for dispatch.

Solvent recovery is remarkable, 99% of the solvent being recovered mainly by distillation, catalyst removal is also very good and there has been no reported difficulties caused by residue catalysts. There are well-equipped laboratories for testing the physical properties such as strength and dimensions and chemical properties such as constitution and dyeing properties. The equipment includes British, American and Swiss machines and among these is a photometric device which can detect differences in shade to the order of 0·01% or between white and whiter. The plant also possesses a cotton mill in miniature which will supplement the laboratory tests.

One of the highlights of the plant is the emphasis on automatic control. Lights, buttons and diagrams, etc., are combined to form impressive switchboards made by Bailey Meters and Controls Ltd. This automatic system allows full control of quality throughout the process. In the utilities section deionized water is made to be used in certain stages of the process, e.g., it is used in the polymer formation. Inert gas is also produced in this section and is used in the storage bins and other places where there is a possibility of dust explosions. Cooling water is drawn into the plant at a rate of 350,000 gall./hour and effluent is conducted along a 10-in. main to the sea seven miles away.

Chemstrand Ltd. are a wholly owned subsidiary of the U.S. parent company which is owned jointly by Monsanto Chemical Co., St. Louis, and American Viscose Corporation, Philadelphia. The U.K. company was registered in 1955.

Jersey Fabrics

Reproduced approximately three-quarter size, linear, the seven distinctive fabrics on the facing page are a selection from the high quality ranges manufactured by Jerseycraft Ltd., Scarr Mills, Lockwood, Huddersfield. Brief details are as follows:—

(1) 2849. High key contrast, i.e., scarlet with black is employed in this diagonal floral jersey.

(2) 6206. A luxurious fabric in a pleasant, light oatmeal shade, the loop effect in this wool/mohair boucle imparts a delightful surface sheen.

(3) 3537. Pastel shades of rose, grey, light blue, royal blue, fawn, russet, light grey and dark grey enhance this remarkably effective striped jersey. The striping arrangement repeats every 3½ ins. across the width.

(4) An extremely effective fabric in dark grey.

(5) 3760. A very attractive check design in dark blue, medium grey and white, with a subdued over-checking in an apricot shade.

(6) Angora basket weave jersey using yarns in two shades of grey and white.

(7) 3843. A two-tone russet/brown check effect on black.

P.V.A. Emulsions in Textile Finishing

P.V.A. finishes will impart added stiffness to a wide range of textiles, also body and a firm, crisp handle. The finishes are relatively stable to laundering

By A. C. KENNETT, D.F.C., B.SC., A.R.I.C., and P. C. EDBROOKE, B.SC., A.R.I.C.

NATURAL products such as starch, glues, gelatin, etc., have been traditionally used for textile finishing to impart fullness, stiffness and body, and in some cases, a crisp handle to many different fabrics. These products, while in many ways eminently suitable for this purpose, have some disadvantages. Insofar as they are natural products, they are liable to batch to batch variation, and they are also of relatively low water resistance. The finish which they impart to the fabric is, therefore, largely removed in any subsequent laundering or washing.

Development of certain high polymers by the chemical industry has resulted in the introduction of alternative finishing materials which have a number of conspicuous advantages. Some of these synthetic polymers can be produced as dispersions in water, polyvinyl acetate being an important example. This paper discusses the use of polyvinyl acetate (P.V.A.) emulsions in textile finishing.

P.V.A. is marketed to the textile industry in the form of a resin dispersion or emulsion in water, the resin particles being of the order of 1μ to 4μ and the solids contents varying from 40-60%. In this form the emulsions are stable under normal conditions and may conveniently be stored in drums for many months without deterioration. Apart from dilution, the emulsion is ready for use in most finishing processes. Further, as the emulsion is water-based, it is a simple process to clean up after the material has been used, and no fire hazards are associated with its employment. P.V.A. emulsions are, therefore, extremely convenient to use in the textile mill.

P.V.A. finishes will impart, to a wide range of textiles, added stiffness, body, and a firm, crisp handle. At the same time, they improve the abrasion resistance of the textile, and in particular, for nylon hosiery, confer snag resistance. The finishes are relatively stable to laundering, being very much more permanent than the equivalent treatments by starch, etc., but less permanent than finishes based on thermo-setting resins, such as urea-formaldehyde and melamine formaldehyde. The thermo-setting resin finishes, however, have the disadvantages of being inherently less stable as resin solutions, of being more critical in application conditions, and of reducing rather than improving the abrasion resistance of the treated textile.

In certain applications the P.V.A. is plasticised to give softer handle and flexibility to the textile. Plasticisation can be effected by addition of an external plasticiser such as dibutyl phthalate but recently internally plasticised vinyl acetate copolymer emulsions have been developed in which the resin is inherently flexible; this flexibility is permanent and does not depend on the presence of external plasticiers, which may be removed by evaporation, migration or leaching out in washing.

Methods of Application

P.V.A. finishes require only to be dried on the cloth and do not require any curing stage. Suitable cloth loadings can be obtained by immersing the material in a standing bath of dilute emulsion and nip rolling the textile to standardise the emulsion take-up. The treated textile is then dried and calendered.

The loadings on the fabric may be adjusted by altering the bath concentration. In cotton stiffening, a high stiffness value is obtained using a bath concentration of 6% solids, medium stiffness, 2-4% solids, and light, 1-2% solids. For rayon stiffening rather less P.V.A. is used to obtain effects similar to those produced on cotton.

Some garments are centrifuged after treatment, and this may occur in laundries. It has been shown that during centrifuging, effluent water contains negligible P.V.A. emulsion indicating that the resin has, therefore, become firmly attached to the textile during the immersion in the dip bath.

An alternative to the standing bath technique is to use an exhaustion bath. This method is used particularly in the finishing of nylon, and using this method the P.V.A. resin is precipitated in a controlled manner on to the fibres. In this process small amounts of exhausting agent are included in a bath of very dilute P.V.A. emulsion. The bath temperature is slowly raised to 100-110°F. and maintained at this level until the P.V.A. resin is deposited into the fibres. The exhausting agents are usually complex cationic reagents such as Velan PF, Dipsanil V, Migasol PJ, etc.

Stiffness

One of the effects claimed for P.V.A. textile finishes is an increase in stiffness, which is resistant to washing, and this has been examined by us in a comparison between Vandike 6100, a polyvinyl acetate emulsion especially recommended for use by the textile industry, and laundry starch, in a standardised stiffness and wash resistance test.

A sample of cotton poplin (15 ins.×6 ins.) is weighed (W1) and then soaked in P.V.A. emulsion diluted to a solids content of 18·9% w/w. The sample is taken from the bath, excess emulsion removed by gentle squeezing (Acme wringer—medium pressure setting) and allowed to dry normally. When nearly dry, the treated textile is hot pressed at about 150°C. and after cooling, its stiffness is determined. In the determination, the angle that 12 ins., 9 ins. and 6 ins

lengths of cloth (supported horizontally at one end and allowed to bend under their own weight) makes with the horizontal are measured and the arithmetic mean (A) of the three values is recorded. The stiffness value (S.V.) is calculated as follows:

$$\text{S.V. (\%)} = \frac{90-A}{90} \times 100$$

The weight of the finished cloth is determined (W2) to obtain the resin loading on the cloth which is required before determining the wash resistance.

$$\text{Resin Loading \%} = \frac{W_2 - W_1}{W_1} \times 100$$

Wash Resistance

A sample as prepared above is washed by agitating in a laboratory washing machine for 5 mins. at 60°C. in 1% Teepol solution. After this treatment the sample is redried and stiffness and resin weight are determined. From the resin weight the percentage of resin loss can be determined.

The poor resistance of laundry starch to washing necessitated that 5 min. wash cycles be used up to 30 mins. duration to demonstrate the superiority of P.V.A. in the application. After the first 30 mins. the P.V.A. treated cloth was washed for a further four 30 mins. washing cycles to determine the rate of resin loss and stiffness retention.

Table 1
Stiffness and Wash Resistance of Cotton Textiles Finished with Vandike 6100 and Laundry Starch

Duration in Washing bath mins.	Stiffness (%)		Wash resistance resin loss (%)	
	6100	Laundry Starch	6100	Laundry Starch
nil	22	18	—	—
5	26½	10	12	60
10	26½	5½	16	88½
15	24½	6½	16	96
20	25½	6½	19	98
25	25½	4½	19	99
30	24½	4½	20	99½
60	22	nil	23	—
90	24½	nil	24	—
120	24	nil	26	—
150	24½	nil	26	—

A relatively heavy resin treatment has been used in order to illustrate the behaviour of P.V.A. resins under prolonged washing, although the wash treatment itself is relatively light. It will be seen that even under these light washing conditions, laundry starch is substantially completely removed from the cloth after 25 mins. washing, while the stiffness is reduced to an extremely low value after 10 mins. washing. Against that, textile treated with Vandike 6100 had, after 150 mins. in the washing bath a stiffness nominally slightly higher than the initial figure.

It is interesting to note in this connection the effect of using plasticised P.V.A. emulsions which have been recommended from time to time. Table 2 below shows the initial resin loading and stiffness for cotton cloth treated with a range of plasticised resins based on Vandike 6100, together with Vandike 3015, which is an internally plasticised copolymer.

Table 2
Wash Resistance of Unplasticised and Plasticised P.V.A. Finished Cotton Textiles

Basic P.V.A. Emulsion	% Plasticiser (Dibutyl phthalate) in resin	Initial		After 5-wash cycles	
		Loading %	Stiffness %	Resin loss %	Stiffness %
6100	Nil	14·9	28	11·4	25½
,,	5%	13·6	22	11·0	23
,,	10%	13·2	12	14·0	20
,,	15%	11·7	5½	21·5	19
,,	20%	12·2	4½	26·6	20
3015	Internally Plasticised	16·0	6½	21·0	8

From this table it will be seen that the plasticised resins while showing some resin loss, actually increase in stiffness, due presumably to the leaching out of the dibutyl phthalate plasticiser. The internally plasticised Vandike 3015, which gives cloth a full but soft handle, essentially retains its stiffness after this 5-wash cycle treatment.

Abrasion Resistance

One of the claims made for the use of P.V.A. emulsions in textile finishing is that the abrasion resistance of the cloth is improved. Table 3 compares the abrasion resistance at various resin loadings with that of a cotton fabric treated with 7% starch.

Table 3
Abrasion Resistance of 6100 and Starch Stiffened Cotton Textiles

Finishing agent	Resin loading % by weight	Abrasion resistance (No. of strokes to rupture)
6100	nil	112
	0·5	150
	1·0	180
	2·0	250
	3·0	340
	4·0	630
	5·5	1220
	7·5	1600
	16·0	3300
Starch	7·0	180

This shows that low and fully economic loadings of Vandike 6100 substantially improve the abrasion resistance, and it will also be remembered that this Vandike 6100 treatment is fast to a number of washings, as illustrated in the earlier section. This abrasion resistance has been measured by the following technique:—

The abrasion tester used at British Oxygen Research and Development Limited is a reciprocating wear test machine made by Nash and Thompson Ltd. suitably modified to measure the abrasion resistance of textiles. In the test the textile is stretched over a brass disc (loaded 340 gms.) which is rubbed mechanically backwards and forwards over a 60 mesh monel gauze (37 gauge) at 100 strokes/min. The abrasion is measured as the number of strokes required to obtain first rupture and this is recorded as abrasion resistance (AR).

Soiling

As it has been suggested that the permanent starching effect produced by P.V.A. might increase the soil deposition, this factor was examined separately.

To investigate this effect, P.V.A. and starch stiffened cotton textiles were contaminated with standard soiling material recommended by the B.L.R.A. J. Text. Inst. 1952, **43**, No. 7. T.331—T.332 and whiteness tests carried out on the fabrics after washing in the presence of certain additives. Efficiency of dirt removal was estimated by using a selenium cell electrophotometer to measure the whiteness of the soiled fabric before and after washing.

It was found that dirt removal was equally efficient with either P.V.A. or starch treated cotton fabrics when metasilicate, or soda ash and 0·003% Cellofas B (sodium carboxymethyl cellulose), as dirt suspension agent was used with the soap powder. However, the metasilicate/C.M.C. system was

preferred as it gave a more efficient removal of the soiling material.

Nylon

The experimental results described above have referred mostly to the treatment of cotton materials by a standing bath technique, whereas, as has been mentioned earlier, the exhaustion technique is more suitable for the treatment of nylon. P.V.A. resin treatments have been used to confer snag resistance, to impart stiffness and to delustre nylon hosiery. P.V.A. emulsions can be used successfully both for pre-boarding and for post-boarding processes; in the latter process emulsions of high molecular weight resins are highly desirable, as the resultant high softening point will minimise blocking on the formers.

A typical process for the exhaustion technique would be as follows:—

0·8 ozs. of Velan PF is dispersed in a gallon of water and added to a mix of 0·9 lbs. of Vandike 6100 P.V.A. emulsion and 24 galls. of water. 10 lbs. of nylon is immersed in this mix and the temperature raised slowly to 110°F., the mix being continuously agitated. These conditions are maintained until the liquor clears, indicating complete exhaustion of P.V.A. resin on to the nylon. The nylon is then removed from the bath and dried in the usual manner. In such processes it is essential that the nylon is agitated freely during exhaustion, in order that even deposition of resin is obtained.

Anti-snag and delustre finishes are obtained with fairly low resin loadings of the order of 1·5-2%. By using suitable emulsions it is possible to obtain these finishes without impairing the handle and drape of the textile. The inclusion of waxes is sometimes found to be advantageous in these processes; the waxes tend to produce a softer handle, reduce blocking and also aid even deposition of the P.V.A. resin on the nylon. Typical bath composition for such finishes are:—

Standing Bath:

Vandike 3015 VA copolymer emulsion	..	**1 parts by weight**
Waxol PA	..	**3 „ „ „**
Water	.. ..	**100 „ „ „**

Exhaustion Bath:

Nylon	.. ..	**4 parts by weight**
Water	.. ..	**100 „ „ „**
Vandike 6100 PVA emulsion	..	**0·14 „ „ „**
Velan PF	..	**0·02 „ „ „**

The multiplicity of types of textiles now produced makes it impossible to lay down hard and fast conditions for specific finishes. It is found in practice that an individual technique has to be developed for each textile.

It can be seen from the results reported in this paper that P.V.A. emulsions can be of great value in textile finishing. Perhaps the greatest single benefit from this type of finish is the increase in abrasion resistance conferred by P.V.A. resins, in which property these resins differ materially from many others commonly used in textile finishing. P.V.A. emulsions are materials easy to handle and, in general, give finishes of superior wash resistance to that obtained from the natural products such as starch. These treatments are, especially in the case of standing bath techniques, simple to carry out, and the materials employed do not require any specialised storage or handling techniques.

Acknowledgements

Acknowledgements are due to the directors of British Oxygen Research and Development Ltd. and British Oxygen Chemicals Ltd. for permission to publish this Paper.

New Finishing Agent*

RECENTLY introduced to the I.C.I. range of textile finishing agents Velan NW is an improved type of durable water-repellent finishing agent also designed for application in resin finishing. By virtue of its softening and lubricating properties, is of value in overcoming the adverse effect of resins—such as the formaldehyde derivatives of urea, melamine and ethylene urea—on the tear strength of cotton and viscose rayon. For this purpose it is incorporated in the resin precondensate, in relatively low concentration, together with the acid catalyst normally used to cure the particular resin being used. Velan NW is capable of wide application in this respect on account of its compatibility with the majority of the resin precondensates and acid during catalysts commonly used. Moreover, its beneficial effect on tear strength is retained after repeated laundering.

While Velan NW has been developed primarily as an agent for conferring durable water repellency on cotton and viscose rayon when applied by baking in the presence of an acid catalyst, it is also very suitable for incorporation in resin finishing baths to produce combined water-repellent/crease-resistant finishes on these fabrics. In using Velan NW for this purpose, however, a higher concentration of the product is necessary than when only softness and lubrication are required. In addition, it is necessary to be more selective in the choice of acid curing catalyst, otherwise the maximum water-repellent properties of Velan NW will not be developed. Suitable catalysts for use with Velan NW in this connection include ammonium dihydrogen phosphate, ammonium thiocyanate, zinc nitrate, zinc chloride and tartaric acid. Since one or other of these catalysts will cure most of the nitrogen resin precondensates in common use there is little, if any, restriction placed on the type of nitrogen resin with which Velan NW may be employed in producing water-repellent/crease-resist finishes. A further advantage of Velan NW in this type of application is that a final washing-off treatment of the fabric is not essential in order to develop the water-repellent properties of the Velan NW.

* *With acknowledgements to I.C.I. Ltd., Dyestuff Division.*

Applications

To Confer Softness and Lubrication.—Used on cotton as a softener and lubricant, an amount of Velan NW is added to the resin bath such that 0·4 - 1·2%, calculated on the weight of fabric, is left on the fabric. On viscose rayon it is advisable to increase the concentration of Velan NW used to 0·8 - 2·0%, again calculated on the weight of fabric. The Velan NW, diluted with water to give a workable cream, is added to the partially diluted resin bath containing the particular precondensate being used, followed by a solution of the acid catalyst normally employed with the precondensate, the whole being finally made up to the required volume with water. The amount of acid catalyst is that usually employed to cure the resin. Other additives, such as thermoplastic polymer dispersions—to provide, for example, improved abrasion resistance—may be added to the bath, if desired. Of the thermoplastic resin dispersions available Bedacryl S and Bedacryl H are particularly suitable. The fabric is then processed in the normal manner, consisting of padding, drying, baking, and washing off if considered necessary.

For Production of Water-Repellent/Crease-Resist Finishes.—For use as a water repellent in the combined water-repellent/crease-resistant finishing of cotton and viscose rayon it is necessary to incorporate 2·0 - 4·0% of Velan NW (calculated on the weight of fabric) in the resin bath, together with the amount of resin precondensate needed to produce the desired finish. A higher usage of Velan NW is required on viscose rayon than on cotton. The amount of catalyst normally used for the resin finish will, in general, suffice when Velan NW is incorporated in such finishes. In order to obtain the optimum water-repellent effect it is recommended to use the following catalysts:—

(1) Ammonium dihydrogen phosphate with urea/formaldehyde.
(2) Ammonium thiocyanate with melamine/formaldehyde.
(3) Zinc nitrate with dimethylol ethylene urea.

The usual sequence of operations—namely, padding of the fabric, drying, baking, and washing off (if desired)—is carried out.

Wool Combing Management*

By R. P. PITCHER†

ONE of the first things a manager should consider is the health of the workers, otherwise work is interrupted, and efficiency lowered. It is necessary to provide good working conditions, good food and, particularly in winter, to introduce preventative measures against the common "cold" and similar ailments which, in total, can lose many man-hours. A good manager should also be able to delegate duties to other executives on various levels to ensure smooth operation in his business.

An organisation requiring the constant presence of its manager to obtain smooth running is usually not well organised or managed. Selection of the right person to exercise these duties is the test of a good manager, as he has to ensure they are technically competent and possess tact. Equally important is the ability to work together; the best results are obtainable only through good team work. A good illustration is two gear-wheels, one ½ and the other ¾ ins. pitch; each is a perfect wheel but put together they do not mesh. The larger the organisation, the more difficult to ensure all these things and at the same time provide against the problem of replacement if someone in the chain drops out. The capacity and strength of mind to make sound decisions at various levels is somewhat rare and it is a virtue unfortunately sadly lacking in many technically qualified people. In wool-combing, the ideal set-up is one in which every employee is considered as taking part in management, managing his own or her own job to the best advantage and realising that each is part of a team.

Personal Contact

It has been said that there are three types of employer:—

(1) The worst is the employer who employs only the hands of his workpeople.
(2) A better type is the employer who employs both the hands and heads of workers.
(3) The best is the one who employs the hands, heads and hearts of all employees.

With such co-operation between employer and employed, there should be every chance of successful production. A good managing director or general manager usually concentrates on ways and means of securing this happy atmosphere in the works and often it is only achieved by the closest personal attention to small details. In addition, he must have the confidence of all as being technically knowledgeable, fair in judgement and appointments and highly efficient in planning ability.

It is part of the managing director's duties to get in close contact with the people in the works to see how they do their jobs. To get that personal atmosphere it is advisable to have a mill or a factory which employs not more than about 500 people. Generally, modern development is for central financial control, with smaller working physical units.

Processing Essentials

The combers' job is to produce tops with level and even slivers of regular weight throughout, free from slubs, neps and vegetable matter, containing the correct amount of moisture and fatty matter. This standard in tops has to be maintained in addition to giving the top-maker the maximum amount of top and minimum amount of noil and waste with the maximum yield, and to ensure the comber some margin of profit from his controlled income.

Buildings should be adapted in the best possible way to deal with the flow of wool through processing with as little physical effort as possible in moving it from one place to another. It is amazing how much this movement of wool costs in man-handling if it is not properly watched, but various mechanical appliances available will speed up and lessen physical effort. Routine repairs, external and internal painting, window cleaning, oiling doors and window hinges, and gutter and drain cleaning should all be regularly and systematically carried out, and it is important to have plans of the drainage systems of the whole mill as these are vital in quickly locating stoppages.

Power Plant

Every wool comber must have a steam raising plant for process work, and in many cases it is linked to some form of mechanical prime mover, such as a steam engine, back pressure unit or turbo-generator, for the power required in the mill. Most mill power plants are extraordinarily clean and attractive looking. Efficiency in both steam-raising and consumption should be scrupulously checked, and very accurate recording instruments are available for these purposes. Under present conditions the engineer is unable to select the coal he prefers. This is unfortunate as coal is an expensive item in production costs, and attention must be devoted to every part of the power plant to obtain maximum economy in working.

Laboratory

The larger wool combing plants usually employ chemists who are responsible for periodic and regular testing of feed water, scouring water, soaps, oils, etc., checking condition in tops, on fatty matter, also recording imperfections such as neps, vegetable matter and slubs in the top slivers. Their department normally controls the extraction of grease from scouring liquors and this is a very important problem today, because River Boards and local authorities are becoming increasingly concerned about what is put into rivers or sewers.

Trade effluents are long outstanding problems in Bradford and District and careful surveys by industrialists and local authorities are necessary with a view to solving the problem to mutual satisfaction. Sewage works are having troubles with the treatment of sewage particularly as housewives now use detergents rather than soap. Efforts have been made recently in the U.S.A., Sweden and Australia to evolve a new continuous solvent scouring system which would cut out the need to put wool scouring liquors into the rivers or the sewers and the additional yield of wool grease would cover the installation and running costs. The whole development is so important that every effort must be made to find some satisfactory process.

Maintenance and Records

Skilled, intelligent fitters are essential for efficient maintenance of machinery. Unfortunately, these men are now more difficult to find, because the trend of the engineering industry is to get away from all round craftsmanship and on to work of a more specialised nature. The training of those men who are so useful and who can turn their hands to any job, is gradually disappearing. The mechanical staff should always be studying ways to get improved driving arrangements and better lubrication, etc. Repair history sheets covering each machine will pin-point weakness and other troubles and help to eliminate or prevent them. Prevention is always better than a cure and individual machine records provide interesting data on repair costs, careless operation, etc.

Research

In every combing mill research of some sort or other continues ceaselessly. It may only be trial and error in some, but experiments are always being made to improve techniques. In quiet times competition between combers is pretty keen. All are out to secure the best results and attract more work. With controlled tariffs operating, the quality of production and yield become an attraction to top makers and the comber with the best reputation is likely to get most work. Management should also keep closely in touch with machine makers to keep abreast of machinery developments.

All combers are members of W.I.R.A. and the Wool Scouring and Combing Sub-Committee meets once a month to discuss problems, complaints and ideas. With the extension to premises W.I.R.A. is now installing commercial size wool scouring and combing machinery, also machinery for other sections of the worsted and woollen industries, but it still seems to lack facilities for getting enough supplies of raw material to operate on a commercial scale. When this problem is overcome it should be able to study many problems in a more practical way.

Every comber has to have the normal books of account but other records are equally important. These must cover hourly, daily or weekly periods as needed, particularly, of the use of consumable stores against production. The records should provide the information that enables

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* *From a lecture given to Halifax Textile Society.*

† *Managing Director, Airedale Combing Co. Ltd., Shipley.*

one to obtain more service from these stores and thus effect lower running costs. Topmakers like to be closely informed as to what running results are being obtained from their wool and the proportions of tops to noil. They like to have final results quickly. Costing of the various processes in wool combing is not difficult, and profit or loss is easily calculated week by week, or day by day if necessary.

Transport and Insurance

A lot of time is wasted when lorries wait outside the mills and warehouses to unload or load wool and tops, etc. It is excellent practice for a combers' warehouse foreman to contact warehouse foremen in spinning mills with a view to unloading lorries quicker or ascertaining the best time for lorries to call. This saves time and helps to reduce costs. A comber has also to bear in mind that he handles and stores raw material that is not his property. If it is owned by a topmaker on whose behalf he processes it, the commission combing tariff includes the cost of insurance. It is most important that every combing manager should make it his job to see that insurance fully covers all contingencies.

Woolsorting and Processing

Wool sorters are usually paid by the topmaker but the comber has to provide good well-lighted sorting accommodation, skeps, ovens for softening up the bales, weighing machines and so on. He has also to have ample and good storage bins in which to blend topmakers' wool and to provide qualified labour for careful blending. The commission comber has to arrange these bins in such a way that each topmaker coming in to inspect his wool is not able to inspect wool belonging to other competitive topmakers.

Processing wool in wool combing comprises willeying or opening, followed by scouring, drying, carding, backwashing, gilling and balling, combing and finishing, and then packing. This is the order in which these operations take place, but in order of importance I would put scouring first, carding second, finishing third, then combing and backwashing. Each is important and constant and vigilant attention to detail is always necessary. Packing is also important. Carelessly and slovenly packed tops or noils create a bad impression. Wool combers in Yorkshire do not need to presspack their tops as is done in most countries overseas, because here the combers' premises are situated near to the spinners' mills. For tops going overseas, the normal practice is to send them through Bradford Conditioning House to get a certificate of water and/or fatty matter content and presspacking, if required, is done there.

Acrylic Fibres: Manufacture, Properties and Uses*

By W. E. OSMUND, B.A.†

BASED upon the development of a large scale production of acrylonitrile during the second world war there has grown, firstly in the U.S.A. and latterly in Europe, a group of successful, purely synthetic fibres. The production of acrylic fibres overtook the total for all other non-cellulosic staple fibres in the U.S.A. in 1954 and by 1957 was running about two and half times that of other non-cellulosics. In the British Isles "Courtelle" has been produced in pilot quantities during the last eighteen months and the commencement of full scale production of "Acrilan" and "Courtelle" is imminent; the total installed capacity being 20 million pounds per annum.

The fibres normally considered as true acrylics are binary or ternary polymers containing about 90 - 95% acrylonitrile. The comonomers are usually about 5 - 8% methyl acrylate or vinyl acetate plus 1 - 2% of a monomer containing a dyeable group in the case of ternary polymers. The dyeable group may be basic or acidic but the general movement recently has been in favour of the latter.

During manufacture a mixture of the monomers is polymerised in the presence of free radical producing initiators. A spinning dope is made from the resulting polymer, the two most favoured solvents being dimethyl formamide and aqueous sodium thiocyanate. Fibre may be produced from dimethyl formamide solutions by dry or wet spinning processes. Sodium thiocyanate solutions are wet spun into an aqueous coagulating bath. The solvents are re-claimed and re-used. The wet spun fibres are stretched after coagulation in the spinning bath and then pass in tow form through washing and drying stages. The dried tow may then be relaxed so that it has a shrinkage in boiling water of not more than 1 to 2% or it may be stretched to give fibre with a shrinkage of 20 - 22%. In either case the tow is then crimped. It may be then packaged as tow or cut as staple.

"Courtelle" is available in filament deniers from 1¼ to 15 and staple lengths of 1 7/8 to 6 ins. The normal tow denier is approximately 500,000. Similar deniers and staple lengths are obtainable for the other acrylic fibres.

The acrylics are moderately strong fibres with high extensibilities, both of which are largely retained when wet. The moisture regain and imbibition are low, so giving fairly rapid drying. The fibres are resistant to organisms and most chemicals although they are attacked slowly by alkalies. The tenacity and extensibility retention in sunlight is very high. Stabilised fibres do not shrink further in hot water. The initial modulus of elasticity is high under wet or dry conditions in the cold but on heating to 95°C. the dry and wet moduli are reduced to about 5 and 1% respectively of the dry modulus at 20°C. Small deformations under hot wet conditions are reversible so no difficulties are encountered in dyeing if cooling is carried out slowly.

A very important stage in the development of the acrylic fibres was the discovery of the high bulk process. Standard stabilised fibre is blended with high shrinkage fibre usually in the ratio of 60 : 40 and spun. The resultant yarns can be bulked by treating in water at 95 to 100°C. or in steam when the high shrinkage component shrinks by about 20% so voluminising the yarn. The bulking may be carried out in yarn or fabric form. For the highest quality knitwear standard tow from the fibre producing plant is stretched between hot plates on the Turbo stapler machine and is then stretch broken over breaker bars to produce a top. A portion of this top is relaxed in steam and blended in the ratio above with unrelaxed top. This is then spun to yarn on the worsted system.

A similar system is the Pacific Converter in which the tows are cut instead of being broken. High bulk worsted yarns can be produced from high shrinkage tows supplied by the fibre manufacturer using the Greenfield Converter. High bulk cotton spun yarns can be made from a blend of standard and high shrinkage staple. The cotton spun high bulk yarns are the cheapest and are very suitable for most uses for the yarns made from the Turbo Stapler are superior for knitwear. The reasons are that because of the necessity of crimping the fibre for the cotton system after stretching, the shrinkage is not as high as for Turbo tops; the high shrinkage fibre is more brittle than the standard and so there is some fibre breakage in the card; and finally higher twist factors are employed in cotton spun yarns.

The dyeability of acrylics varies for the different fibres but in general all shades can be obtained although the darkest ones may be rather expensive. All types of dyeing from stock and tow dyeing through to piece and garment dyeing may be used. Acrylics may also be printed.

A large field for the acrylics is in knitwear. Bulking may be carried out in yarn or garment form and is often done in the dye bath. Jersey fabrics have been very successful; for the single knit type high bulk yarns should be used but for the double knit, standard or high bulk yarn is possible. Very comfortable, stable underwear for men and women are made from 100% acrylics. These may be shaped or cut garments from standard or high bulk yarns. The acrylics are very suitable for fur fabrics.

On the woven side the acrylics can be used as 100% or in blends with cotton, wool or "Fibro," to produce a wide range of durably pleatable skirtings and trousering, suitings and gaberdines. Some very attractive lightweight washable dress fabrics which can be printed have been produced. Because of the stability to washing the acrylics are very suitable for blankets.

In all uses the acrylics give warmth, softness and lightness which may perhaps be summarised in the word comfort. They give strong fabrics of high stability which do not deform on washing. Garments made from the acrylics give fairly quick drying, creases are shed and they need little ironing. They are resistant to moths and chemicals. Because of these properties the acrylic fibres are bound to find increasing acceptance in the years to come.

* *Report of a lecture to Braintree and District Textile Society.*

† *Courtaulds Ltd., Coventry.*

Rayon Weaving Problems*

Most of the troubles which occur when weaving fabrics from man-made fibres also arise when weaving the natural fibres, but defects which are often hidden in the general unevenness of a spun yarn are plainly visible in fabrics made from filament yarns which are of great uniformity

By G. TURTON†

A WELL prepared warp is an essential requirement for the production of high quality fabrics. The old type of wooden beam with a 4 ins. dia. barrel and cast iron or pressed steel flanges cannot be regarded as suitable for use with man-made fibres. Old wooden beams are often eccentric and can produce undesirable weft bars in the fabric. Many in use now are worn out due to repeated flange setting causing disintegration of the wood; consequently, there is a risk that the flange setting will not be secure enough.

Longer length warps are now in general use and therefore, flange setting must, be both accurate and positive. Under certain conditions, particularly with some of the newer synthetic fibres such as nylon, enormous pressures build up in the yarn on the beam and any subsequent disturbance of the flange setting will lead to cracking of the warp.

A substantial, precision built, light alloy beam, preferably with robust screw-on flanges, held in position with an annular locking ring stands up to the stresses imposed by the warp. Flanges of this type will not move under the sideways thrust of the warp and are easily adjusted to width.

The barrel should not be less than 6 ins. dia. With negative let-off motions a small barrel diameter makes it difficult to maintain even warp tension and a uniform rate of let-off towards the end of the warp. A large diameter barrel also facilitates the making of a much better warp. The amount of yarn which can be contained on the beam will be reduced by increasing the barrel diameter from 4 to 6 ins. but this can be offset by an increase in flange diameter of 0·5 in. for an 18 ins. flange, and 0·4 in., for a 24 ins. flange. The barrel should contain yarn holes so that the warp ends can be held securely. Slippage or bulging of the warp in the initial stages of warping is then avoided. If space will allow, flanges should always be set 2 to 3 ins. further apart than the reed width as this allows better spreading of the warp ends in the healds, and prevents the outer threads chafing against the flanges as the warp is drawn off.

Healds and Reeds

Most continuous filament yarns are of low twist and the risk of damage to individual filaments by abrasion is greater than for spun yarns. As far as the warp is concerned most abrasion during weaving occurs in the healds and the reed. While sizing goes a long way in affording protection to the warp threads, the correct choice of healds and reeds is essential for the production of good quality fabric.

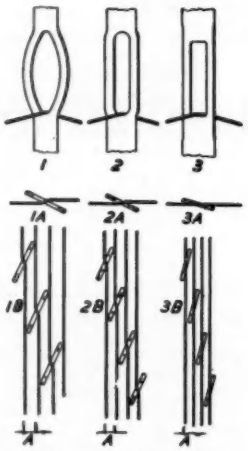


Fig. 1. Angular deflection of thread

Varnished cotton healds should not, under any consideration, be used in weaving continuous filament yarns. The knit-wire type of heald shaft, while suitable for a certain range of fabrics—mainly in the lower setts—has too many inherent disadvantages to be recommended for weaving continuous filament yarns. The two wire lease rods for separating the healds when drawing-in, restrict the free movement of the healds and also makes the depth of shed setting more critical.

Knit-wire healds are built up with a given number of healds per inch on the frame, according to the number of ends per inch contained in the warp, therefore, they can only be used for warps with the correct number of ends, or warps with a smaller number of ends, by casting out a certain number of healds in a given order. Casting out, however, is not recommended with continuous filament yarns. This leads to cramming of the threads at the junctions of the empty healds, with slight displacement of the warp threads between the healds and reed, causing extra abrasion at these points.

The best type of healds for use with continuous filament yarn are the all-metal frames with flat steel healds, preferably "Duplex" with a rectangular eye. They are more rigid than most types, which ensures smoother shedding. "Duplex" healds allow an increase of from 25% to 33% more healds per shaft, according to the warp denier and the heald dimensions, without undue cramming of the warp threads in the healds. This is a decided advantage when weaving warps with a high number of ends, because it reduces the number of heald shafts required, thus reducing strain on the warp during shedding, e.g. a warp 40 ins. in reed containing 8,000 ends would have to be woven on six shafts using flat steel healds, but could be woven quite easily on four shafts with "Duplex" healds.

The advantage of using healds with a rectangular eye are twofold. Assuming that the force to form a shed with a single end is constant, this load is distributed over a larger area of contact when using the rectangular eye, and therefore, the pressure on the length of yarn is lower than with the conventional elliptical eye. This reduced pressure between yarn and heald eye tends to reduce abrasive action in shedding.

Slight rotational movement about its vertical axis, of healds with other shapes of eye will cause relatively large angular deflection of the warp thread. In contrast a similar movement of a heald with rectangular eye will cause little or no displacement of the warp thread Fig. 1a, 2a and 3a. This angular deflection of the thread limits

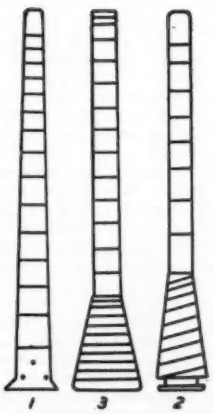


Fig. 2. 1—pirns with slight taper from base to tip; 2—pirns with full built-up conical base; 3—pirns with half built-up conical base

* *From a paper given recently to Colne and District Textile Society.*

† *British Rayon Research Association.*

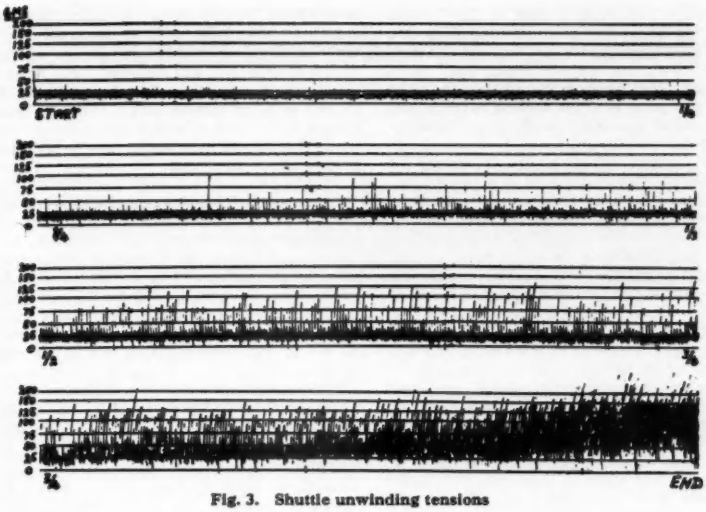


Fig. 3. Shuttle unwinding tensions

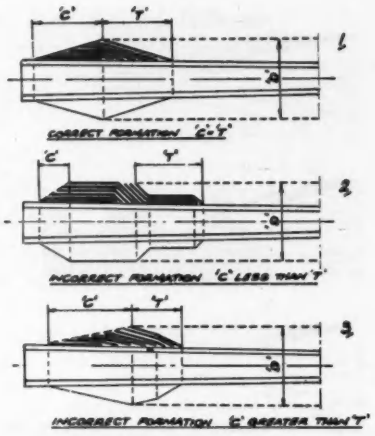


Fig. 5. Pirns without bases

the number of healds per inch as defined by distance A Fig. 1b, 2b and 3b.

Healds should be deep enough to give good depth of shed. Whatever means of shedding are employed, the healds should operate with a steady rise and fall without sideways or rocking movement. Heald frames must be clear from reed case and crank arms, any such interference will result in additional weaving friction. Avoid overcrowding of healds on shafts. Clean and polish slider rods frequently so that healds and dividing hooks move easily, avoiding bunching of healds which can cause warp streaks in the fabric. The use of too large a reed hook in drawing-in and weaving can cause damage to the heald eye, resulting in broken filaments during weaving. Healds should be cleaned at regular intervals to remove dirt and size deposits. Dirty sticky healds can result in bad weavability, especially when fine denier high reeded fabrics are being woven.

The best type of reed to use with continuous filament yarn is undoubtedly an all-metal one with soldered baulks and well-polished rounded-edged reed wires. Soldered baulk metal reeds are more rigid and more uniform dent by dent, than the pitch baulk type. The depth between baulks must be kept within reasonable proportion in relation to the gauge of the wire otherwise the reed will be too springy. The reed should have sufficient rigidity to maintain even distribution of the warp ends, and place the weft at the cloth fell without springing. Healds and reeds should be kept clean, free from rust and stored in a warm dry atmosphere. It is preferable to store reeds on shelves, since standing them on end may result in the reed bending with consequent distortion and bending of the reed wires.

Winding

During the years when most weaving was concerned with the natural fibres, a great deal more latitude was permissible in the winding room, and the person who looked after the pirn winding, generally had other duties to perform, winding often being the secondary one. All that was required of him was the ability to carry out minor repairs or adjustments, as and when necessary. Wrong adjustments or wrong techniques did not in those days produce a great deal of faulty cloth.

With the advent of so many synthetic fibres, each with its own properties and characteristics, coupled with the introduction of the precision built pirn winder, capable of running at very high speeds, and often fully automatic, the person in charge of pirn winding should be a good mechanic, have some knowledge of certain characteristics of the materials he may be called upon to use, and also be able to use a tensiometer, interpret its readings correctly, and be able to make the appropriate adjustments.

A good winding overlooker is equally as important as a good loom overlooker and can materially assist in the production of good quality cloth.

Choice of Pirn.—Although pirns are used in many shapes and sizes, they can be separated into three clearly defined types.

(1) Pirns with slight taper from base to tip.
(2) Pirns with full built-up conical base.
(3) Pirns with half built-up conical base.

Types 1 and 3 are in use with practically all kinds of yarn.
Type 2 is more often used with woollen and other coarse hairy yarns.

There are, however, certain desirable features required in any pirn which is intended for use with continuous filament yarns, no matter whether the pirn is made from wood, compressed paper, metal, or plastic material. These can be listed briefly as follows: They must be capable of good finish and stand up to a certain amount of rough usage. They must also allow good yarn retention, without impeding the free withdrawal of yarn during weaving, be free from eccentricity or warping. Eccentric or bent pirns should be discarded. The choice of pirn depends to a large extent on the type of yarn to be wound, and to a lesser extent on the type of loom in which it is to be woven. Automatic looms impose certain restrictions on the choice of pirn shape, due mainly to the type of feeler which is employed.

Most automatic pirn changing looms use a side sweep feeler, which for satisfactory working, requires a cylindrical pirn with a smooth section free from grooves at the base end. With the cylindrical pirn, however, it is often extremely difficult to avoid a sharp rise in tension towards the end of the pirn as the yarn unwinds from the shuttle during weaving. This rise in tension is caused by the increase in friction due to the yarn licking round the stem, and also being withdrawn over the parallel layers of yarn which are formed at the commencement of winding. The half conical based pirn will help to reduce the beginning to end variations in tension, and still maintain good yarn retention in the

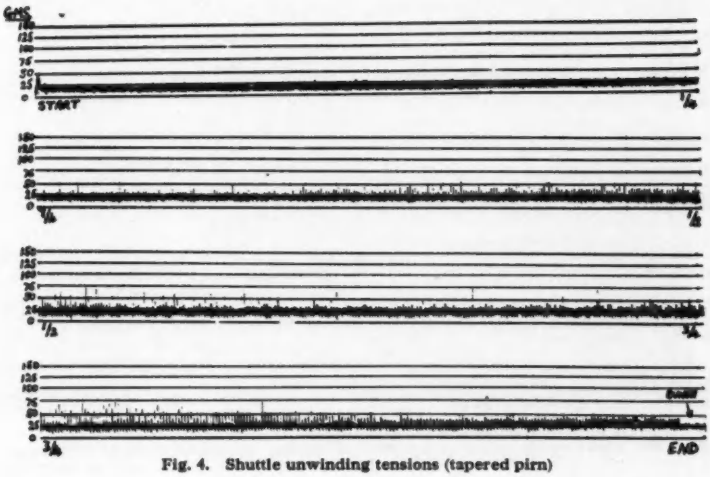


Fig. 4. Shuttle unwinding tensions (tapered pirn)

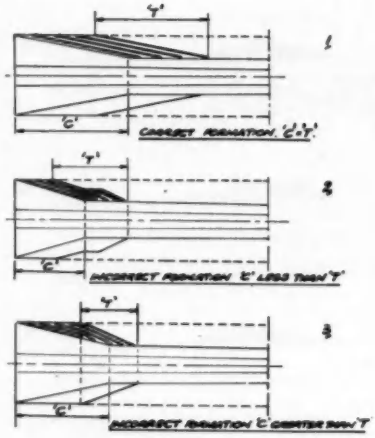


Fig. 6. Pirns with bases

last stages of weaving off. The full conical based pirn gives the best results when weaving off, but the steepness of the cone angle, would, with filament yarns make it very difficult to retain the last coils of yarn without resorting to substantial grooving.

Pirn Build.—One of the most important requirements for good pirning and good weaving, is to ensure that the pirn is built or shaped correctly. If the various builder motions are set to produce a symmetrical or well-shaped pirn, a much lower winding tension is possible, than is the case with a mis-shapen or malformed weft package. The most common faults consists of incorrect setting of the cop former, or the mechanism which governs the traverse length. For cylindrical pirns, the simple but important rule to be observed, is that the length of the taper at the base of the pirn, which is determined by the cop former, should be equal to the traverse length. Any deviation from this rule will cause faulty displacement of the layers of yarn during the early stages of winding, and will tend to reduce the stability of the wound pirn.

When winding pirns with a built-up base, it is essential that the traverse length is equal to the axial length of the conical base. If the traverse is longer than the base the resultant pirn is often wound with a soft nose, leading to "sloughing" from the nose. If the traverse is shorter than the base, the pirn is often wound with a soft or rounded shoulder, leading to "sloughing" from the shoulder.

For correct winding, the diameter of the wound package should not exceed the maximum diameter of the built-up base. In certain cases, however, particularly with pirns having a half built-up base, it may be desirable to increase the package diameter over the base diameter. If this is the case the cop former should be set to give the same length as the traverse no matter how shallow the angle, so that there is equal displacement of the layers of yarn during the initial stages of the winding.

Another common fault which can lead to pirns being wound with a soft nose, is the incorrect distance setting between the builder wheel and the pirn at the commencement of winding. If this distance is too great, the yarn is laid parallel until sufficient yarn has been wound on the pirn to bring the builder wheel into operation. Successive layers of yarn will then be displaced causing instability of the wound pirn. These wrong settings lead to pirn instability and to counteract this the mistaken course of applying a higher winding tension is often resorted to, the best remedy of course is to ensure the correct shaping of the pirn.

Chase Angle.—The chase angle is determined by the traverse length and the diameter of the wound package. A short traverse and a large package diameter will result in a steep chase angle, conversely a long traverse and a small diameter will result in a shallow chase angle. The fundamental consideration is that a shallow chase angle reduces the amount of yarn which can be contained on the pirn, and a steep chase angle produces the danger of "sloughing" off. It is more important from a quality point of view, that the chase angle be chosen in accordance with the type of yarn to be wound rather than the amount of yarn contained on the pirn.

A steep chase angle can be used with yarns of high frictional properties, such as staple fibres, and shallower chase angles must be used with filament yarns which are smooth and of low frictional properties. It has been found in practice that for continuous filament yarns a chase angle in the range of 6 to 10° can be used. For staple fibres chase angles in the range from 10 to 18° will be satisfactory. Within these ranges the choice of chase angle should be made in accordance with the individual properties of the yarn.

Wind ratio and Layer Locking.—The number of coils of yarn per chase is known as the "wind". In practice, 5, 7 and 10 winds have been found to be suitable for most types of yarn, of the three, the 7 wind is probably the most widely used for both continuous filament and spun yarns. The lower wind ratios, however, impose certain limitations on spindle speeds, due to the inertia of the reciprocating action of the traverse mechanism. In recent years some manufacturers of winding machinery have increased the wind ratio in order to obtain higher spindle speeds. With these higher wind ratios some form of layer locking is desirable.

Layer locking in its simplest form is generally applied in three consecutive traverses, one advanced slightly, one normal and one retarded. This has the effect of binding the layers of yarn as the yarn is wound. The other advantage is that it helps to prevent the formation of a soft nose, because the tendency to lay layer upon layer of yarn is removed. In addition, lower winding tensions can be used, with less danger of "sloughing" off during weaving. Whip or spindle eccentricity will produce a pirn which is tapered, the amount of taper varying in relation to the amount of spindle eccentricity. Spindle eccentricity can also cause wide variations in the winding tension, which if high enough will lead to over-strained yarn.

Supply Package.—Winding by unrolling from the supply package leads to wide variations in yarn tension and should be resorted to only in exceptional cases, and then only in conjunction with some sensitive braking arrangement, which compensates for reduction in diameter of the cheese. In arranging the cone or bobbin from which the weft is unwound, care should be taken that the thread runs as far as possible in a straight path from the supply package to the pirn. Changes in direction necessitate the use of guides and

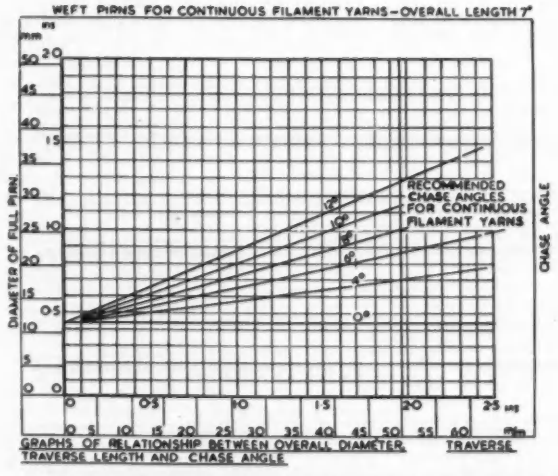

WEFT PIRNS FOR CONTINUOUS FILAMENT YARNS – OVERALL LENGTH T
DIAMETER OF FULL PIRN
CHASE ANGLE
RECOMMENDED CHASE ANGLES FOR CONTINUOUS FILAMENT YARNS
GRAPHS OF RELATIONSHIP BETWEEN OVERALL DIAMETER, TRAVERSE LENGTH AND CHASE ANGLE
TRAVERSE

Fig. 7. Relationship between diameter, traverse length and chase angle for filament yarn (with acknowledgements to British Standards Institute—B.S. 2098)

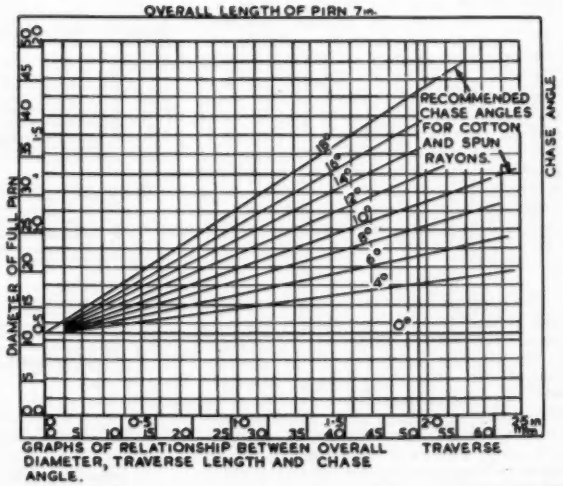

OVERALL LENGTH OF PIRN T
DIAMETER OF FULL PIRN
CHASE ANGLE
RECOMMENDED CHASE ANGLES FOR COTTON AND SPUN RAYONS.
GRAPHS OF RELATIONSHIP BETWEEN OVERALL DIAMETER, TRAVERSE LENGTH AND CHASE ANGLE.
TRAVERSE

Fig. 8. Relationship between diameter, traverse length and chase angle for spun yarns (with acknowledgements to British Standards Institute)

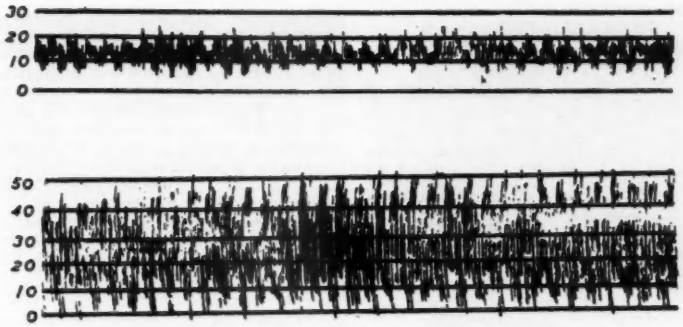


Fig. 9. Effect of spindle eccentricity on winding tension

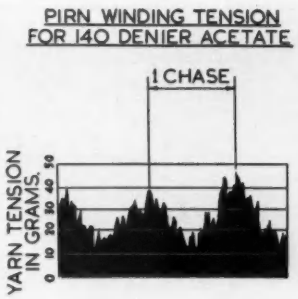


Fig. 10. Typical tension trace recorded with an electronic tensiometer

these increase the danger of abrasion, displacement of twist, and generation of static electricity. Straight paths therefore help to maintain good yarn quality, and winding over-end from the package appears to be the best method.

Where guides are used it is preferable that they be manufactured from one of the newer ceramics, which amongst other properties, have a high resistance to abrasion and a low co-efficient of friction.

Guides with a matt finish should be used with low twist yarns, since their effective area of contact is smaller than that of smooth guides and hence the friction is less. Smooth guides may, however, be used for yarns with high twist, say from 15 t.p.i. and upwards. In most cases it is better to use a conducting material to prevent static build up. Guides should always be kept clean and free from roughness or grooves.

Tension Devices.—The importance of proper setting and control of tension in pirn winding cannot be over-emphasised. Too high a tension, or large variations in tension will overstretch the yarn, and too low a tension will lead to ringing or "sloughing" off. It follows therefore, that not only should the mean winding tension be kept as low as practicable, but also, that the variations in tension should be kept to a minimum.

The simplest and most widely used tension device is the gate tension, generally used in conjunction with an overhead spring compensator. The purpose of the compensator is to smooth out the rapid cyclic variations in tension which occur in the process of winding the pirn. The overhead spring compensator is fairly effective in dealing with sudden rises in tension, difficulties arise, however, from the periodic tension variations, inherent in pirn winding. Frequently, the compensator is out of step with these variations, and instead of decreasing them it tends to amplify them.

In spite of this fact, by taking extreme care in settings and paying strict attention to the winding tension, good weft preparation can be maintained. During the last few years development in winding tension devices have been away from the gate and compensator, and have centred in the main around the self compensating, single or double disc type of tension device. With this type of device, tension is created in the travelling yarn by one or two sets of pre-loaded discs. Constant tension is maintained by the action of the short control arm in relieving the pressure as required. Fluctuations in yarn tension activate the control arm, which, working in conjunction with the discs, compensate very quickly for the variation in tension.

A wide range of winding tensions can be obtained by increasing or reducing the load on the discs with some form of spring adjustment. This type of tension device is capable of following the rapid cyclic fluctuations in yarn tension, which makes it possible to wind a stable weft package at a low mean winding tension, even at comparatively high spindle speeds. Although disc tensions, on the one hand lend themselves admirably to sensitive and accurate tension control, there is a tendency, particularly with coarse denier low twist yarns, to disturb or back up the twist, therefore, it is important that the discs should be kept free from lint or loose fibres, so that they are free to revolve, and that the winding tension be kept as low as possible, consistent with freedom from "sloughing."

Winding Tensions.—The correct choice of the winding tension to be applied to any yarn is very important. A yarn may be only slightly overstretched in winding and this may be unnoticeable in the grey cloth, but after the fabric has been dyed the overstretched yarn will show up as streaks in the finished material, due to differences in dye uptake.

This emphasises the need for strict tension control, because by the time a winding fault has been spotted in the finished cloth, large stocks of fabric may already be affected. A yarn which is severely overstretched in winding will show up immediately in the fabric in the form of bright picks, but even in this case a considerable number of pieces throughout the weaving shed may be affected before the matter can be rectified.

Increase in either spindle speed or yarn denier, correspondingly causes an increase in the short period fluctuations in the winding tensions. Therefore it is important, particularly when winding at higher speeds that the peak tensions do not go over the yield point of the yarn and thereby cause the yarn to be overstrained.

Yarn Properties

There are two properties of man-made filament yarns which are of importance in pirn winding. These are non-elastic extension under load, and elastic recovery. These two factors have a bearing on the amount of winding tension which can be applied to the yarn. Acetate, triacetate and viscose yarns reach their yield point with loads somewhere between one-half and one gramme/den. Therefore, it is important

Fig. 11. A piece of fabric in which the weft has been overstretched during pirning (left) loom state fabric (right) the fabric has been wetted-out and further relaxation has occurred

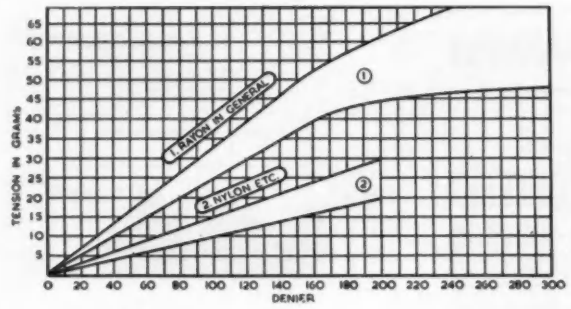


Fig. 12. Graph of winding tensions for use with various yarns and devices. With the finer deniers of nylon the figures shown cannot generally be obtained with the conventional gate and compensator tension device

that the yarn tension at any time during the winding cycle should be kept well below these values.

This explains why in the preceding graph a winding tension of one-quarter to one-third of a gramme per denier was recommended. While the yield point of nylon is much higher, approximately 4·5 grammes/den., it must not be concluded from this that correspondingly higher winding tensions are permissible. On the contrary a lower winding tension should be used because of the greater elastic recovery of nylon. This high elastic recovery of nylon means that in a package wound under a high tension, a high pressure is exerted on the pirn or whatever the yarn is wound on to, which leads to crushing of the pirn or bobbin. Furthermore elastic recovery often takes place in the woven fabric leading to weft bars and seersucker effects.

Conclusions

It should be realised that pirn winding plays a very important part in the production of good quality fabrics. Therefore, strict attention should be paid to the choice of pirns and tension device, and to maintaining the correct settings of the various builder motions, so that all pirns coming from the machine are of a high standard. Winding tensions should be checked frequently using a good reliable tensiometer. Many of the problems encountered in weaving can be avoided by proper care and attention in the winding room.

The old Lancashire type loom generally falls short of the requirements of man-made fibres and the fact that for a number of years many of these looms have produced a fair standard of quality is a credit to the craft and skill of the overlookers and weavers rather than to the loom. With our overseas competitors the precision built loom seems to be the rule rather than the exception. There can be no doubt that for the weaving of man-made fibres the introduction of modern machinery must be the long term objective. In the meantime, however, every effort must be made to raise cloth quality on the existing machinery to the highest possible level and to see that this level is maintained.

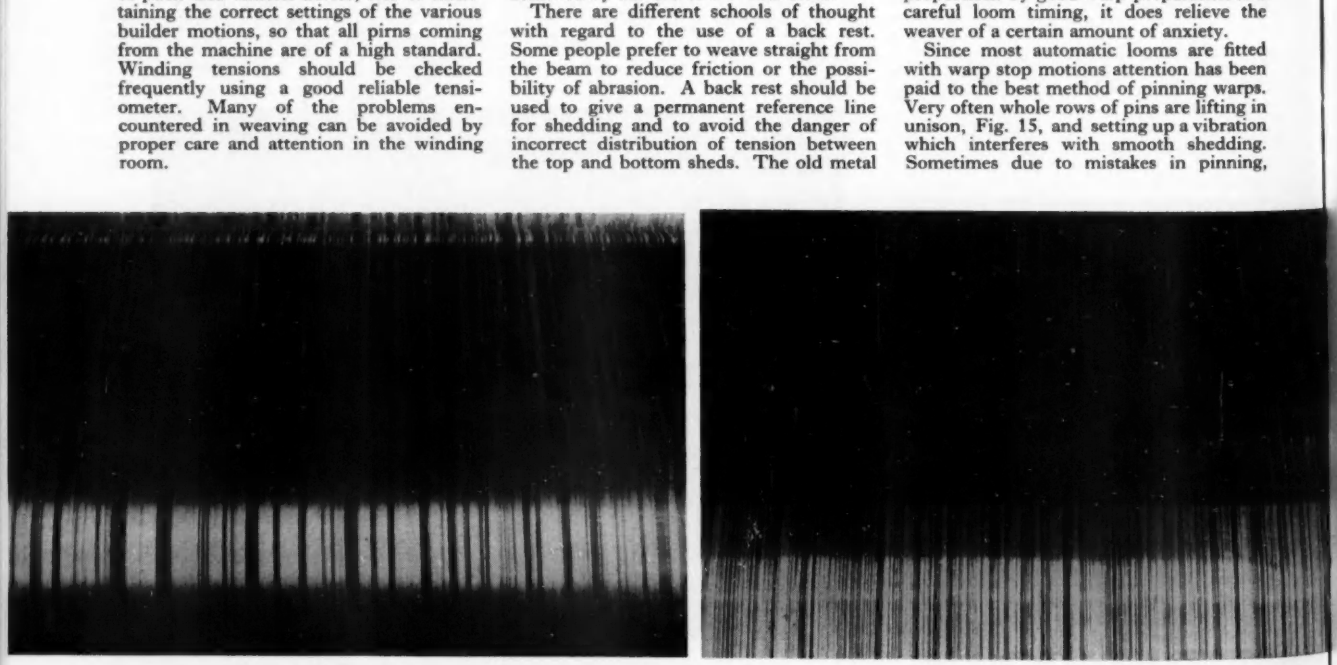
If an old loom is intended to weave certain types of man-made fibres it is desirable that it should first be completely overhauled to ensure that all moving parts are working smoothly and vibration is kept to a minimum. In the driving and take-up motions cast gears should be replaced by cut gears and the crank arms should be perfectly fitted to eliminate back-lash in the sley. Steady running of the loom must be ensured by direct or clutch drive. Slip must be kept to a minimum and this can be achieved by the use of a V-belt drive.

There are different schools of thought with regard to the use of a back rest. Some people prefer to weave straight from the beam to reduce friction or the possibility of abrasion. A back rest should be used to give a permanent reference line for shedding and to avoid the danger of incorrect distribution of tension between the top and bottom sheds. The old metal bar type of back rest which is springy and often rough and scarred from long usage is not suitable for use with filament yarns. It should be replaced by a fluted well-polished hard-wood roller of about 3 or 4 ins. dia., revolving freely. The fluting materially reduces friction and allows displaced threads to return to their proper position, whereas a plain roller tends to collect the threads in ribbon fashion. The brackets supporting the back roller should be so designed that the height of the back roller can be accurately adjusted and should be firm enough to ensure permanency of setting.

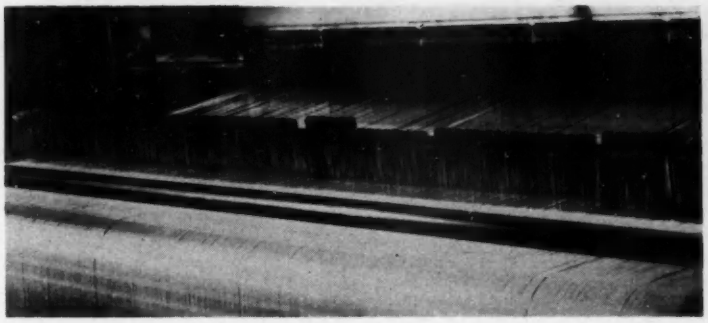
The choice of a suitable covering for the cloth take-up roller is important. The cloth must be held firmly as any slippage, however slight, is liable to affect pick-spacing. With yarns of low twist, the use of emery covered rollers may cause abrasion of filaments in the fabric. If cork strip is used there is danger of the cork absorbing oil from the warp after a time, and then depositing it during a stoppage on the fabric which happens to be in contact with the roller. The best covering for the take-up roller has proved to be of moulded cat's tongue surfaced synthetic rubber, as this is sufficiently oil resistant to give good results over a long period.

If the cloth is wound on the cloth roller by pressure contact with the take-up roller, creases are often formed in the grey cloth and there is a danger that these creases will show up in dyeing. A separate negative drive for the cloth roller is therefore highly desirable. Often these creases are due to bulky selvedges and can largely be overcome by re-denting the selvedges so as to spread them out to give a flatter surface. A weft feeler motion which will stop the loom before the loom is completely empty will help to maintain quality. Another aid which ought to be considered is a warp stop motion, although warp breaks can be reduced to negligible proportions by good warp preparation and careful loom timing, it does relieve the weaver of a certain amount of anxiety.

Since most automatic looms are fitted with warp stop motions attention has been paid to the best method of pinning warps. Very often whole rows of pins are lifting in unison, Fig. 15, and setting up a vibration which interferes with smooth shedding. Sometimes due to mistakes in pinning,



Figs. 13 and 14. The old metal bar type of back rest—often rough and scarred from long usage—is not suitable for filament warp. It should be replaced by a fluted, well-polished hardwood roller 3 to 4 ins. dia., revolving freely



(above) Fig. 16. Due to mistakes in pinning, blocks of pins, randomly distributed, lift together

(left) Fig. 15. Whole rows of pins are often lifting in unison

blocks of pins randomly distributed over the various rows are lifting together Fig. 16. Not only is this unsightly but it may cause section marks in the more delicate fabrics. Both effects are the result of a relation between the number of shafts and the number of rows of pins, so that ends drawn in certain shafts are always drawn in certain rows of pins also. Under these conditions any mistake in pinning will create blocks of pins.

These effects can be avoided by observing the following rule. The number of heald shafts and the number of rows of pins must not have a common factor, e.g. do not use two or four rows of pins for a plain weave on four shafts; use three or five rows (according to the number of ends in the warp). This ensures that ends from any given heald shaft are distributed over all rows of pins and vice versa. Thus at every lift some pins in each row are up and some down, Fig. 17, and friction between adjacent pins reduces vibration to a minimum. In addition, pinning mistakes do not cause randomly distributed blocks of pins.

Temples are always liable to set up additional stresses and strains in the fabric and should only be used if they are really necessary. If temples have to be used they should be adjusted so that the cloth fell can retain its natural position in the parts held by them and is neither raised nor depressed. If the cloth fell in the temples is at a different height from the cloth fell in the centre of the fabric there will be a different distribution of tension between the top and bottom shed, and adjustments of the heald shafts or the back roller which are correct for the centre of the cloth will not be correct for the parts held by the temples. Furthermore, if the temples interfere with the horizontal lay of the cloth fell, cannage is often in evidence at the point where the temples cease to hold the fabric.

The let-off motion most commonly used in industry is the negative friction type in the form of ropes or chains round the beam ruffles and connected to levers carrying weights. The ideal let-off motion will unwind the same amount of warp for every pick. In practice this is never achieved and the let-off follows a rhythm which often corresponds to the repeat of the weave or multiples of it. Serious trouble only starts when this rhythm becomes too pronounced, e.g. when weaving a five shaft satin the beam may not move at all for four picks and then let-off with a jerk at the fifth pick.

This kind of irregularity may be due to sticking in the let-off motion but may also be caused by excessive differences in the lift of individual heald shafts. The worst type of weft bars will appear where the motion of the beam bears no relation to the weave.

Shedding

With continuous filament yarn, shed formation and timing are more critical than they are with spun yarns. The ideal shed formation would be one where all the warp threads in the different heald shafts would be under uniform tension since tension differences give rise to various weaving faults. A clear shed, however, requires a higher lift for the back shafts and this makes uniformity in tension impossible. Greater uniformity can be achieved, by adjusting the back rest to allow a longer free length of warp. To avoid unnecessary strain on the warp the shed should not exceed the height of the front wall of the shuttle by more than $\frac{1}{8}$ to $\frac{1}{4}$ in. when the shed is fully open.

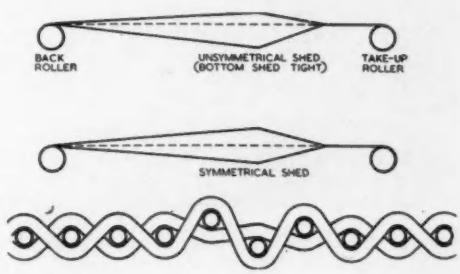
If on the other hand the shed is too small the shuttle may mark the warp threads. These marks may only show up when the piece is dyed and finished, and therefore careful adjustment of the height of the shed is essential even if no trouble is experienced in weaving. When gaiting up, the first shaft should be set to the correct height to ensure a clear shed and all other shafts should be set to the same shed height using a pencil line across the reed as a reference. The bottom shed should be adjusted so that the warp threads rest lightly on the race board covering.

A factor of considerable importance, particularly with plain weaves is the distribution of warp tension between top and bottom shed. There is a tradition in cotton weaving in order to obtain better cover, of putting less tension on the top shed, with the result that during a loom stoppage with open shed the warp ends are stretched by different amounts and a repping fault will appear at the setting on place. In cotton yarns this effect will, in general, only be observed if the loom has been stopped with fully open shed for a very long time. In filament yarns matters are far more critical and a repping fault will often occur after a short stoppage with open shed, or after a long stoppage with slightly open or even closed shed.

It is, therefore, desirable to make the tension in top and bottom sheds equal by suitable adjustments to the height of the back rest.

This can most easily be achieved by use of the Manra warp tension balance an

(left) Fig. 17. At every lift some pins in each row are up and some down. In this manner, friction between adjacent pins reduces vibration to a minimum



(right) Fig. 18. Diagram showing repping place

instrument which makes it possible to compare the warp tension in both sheds on the running loom. The instrument consists of a dial calibrated in angular degrees from + 30 to — 30. A pointer accurately balanced, pivoted at the bottom centre carries two studs which act in the form of a lease rod. The two threads, or sets of threads under test pass through two sets of yarn guides. One set of threads passes over the top stud and the other set under the bottom stud. The tension in the top threads tends to rotate the pointer to the negative end of the scale, while the tension in the bottom threads rotates the pointer to the positive end. When the tensions are equal the pointer indicates zero. A positive reading indicates that the bottom threads are under higher tension, and a negative reading indicates that the top threads are under higher tension. The tension balance can also be used to standardise back rest settings for fabrics where a certain amount of cover is desirable.

Where lease rods are in use, correct choice of lease can be of material assistance in reducing tension differences in the warp ends. A 1×1 lease in plain weaves, will tend to equalise tensions in the two warp sheets because any difference in tension will cause the rods to be displaced in such a manner that the slacker ends are taken up and the tighter ones relieved, with the result that tensions are levelled out.

It is hardly worth stressing the fact that a proper control of warp tension is necessary in weaving filament yarn. The source of warp tension lies in the let-off motion and any effort to adjust warp tension to a desired value and to ensure that this value is maintained, must be centred on the let-off motion. When one comes to the point of testing the result of any such adjustment, however, one is faced with the somewhat anomalous position that there is no satisfactory method available in mills for measuring warp tension and that everything depends on the personal judgment of the overlooker or weaver.

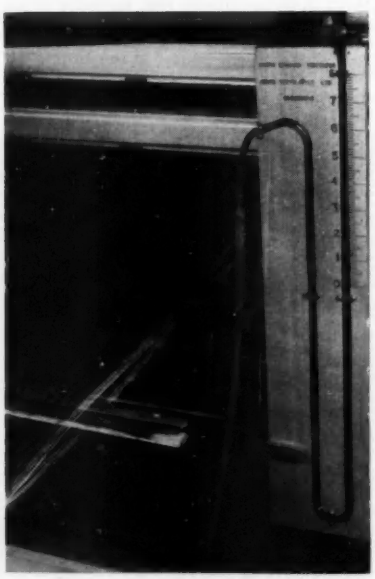


Fig. 20. The Manra lease rod tension indicator

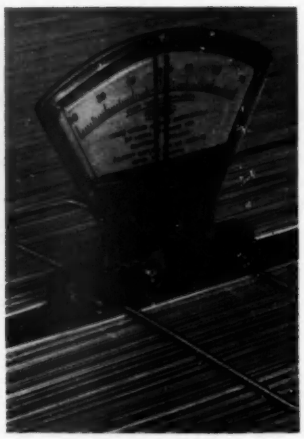


Fig. 19 The Manra warp tension balance

Variations in warp tension can lead to excessive warp breakages, variation in cloth width and length, banging-off, shuttle traps and many other faults. The Manra lease rod tension indicator now available commercially, can help to eliminate these problems. The instrument consists essentially of a lease rod which is sensitive to the pressure exerted on it by the warp tension, and a gauge to measure this pressure. The rod is split lengthwise into two parts. Between the two parts is a thin walled rubber tube which at one end has a metal union protruding through the bottom rod. A rubber tube is joined to this by means of a screw-on union and is easily detachable. The rubber connecting tube leads to a simple U-tube monometer.

The tube of the monometer is made of nylon and is unbreakable and contains an indicator liquid which in most cases is oil, but for very high tension Bromoform is used. Along one of the vertical arms of the U-tube is a calibrated scale in 1/10 divisions from 0 to 80. When there is no pressure on the rod, or the monometer is disconnected from the rod the liquid level is at zero. Broadly speaking, the overlooker when gaiting a new warp, adjusts the warp tension to the best weaving conditions, records the figure showing on the scale and then maintains the same value, by appropriate adjustments to the beam weighting, for the whole of the warp.

Weft Tension

By withdrawing weft from a stationary shuttle and measuring its tension we can gauge fairly accurately the tension in the weft thread as the shuttle flies across the loom (withdrawal tension). Investigations at B.R.R.A. have shown that from the point of view of cloth quality what matters most is the tension in the weft when the shed crosses (final tension) and the final tension is, in general, not identified with the withdrawal tension, because the weft tension tends to fall after the shuttle arrives in the box. The relation between the withdrawal and final tension has been found to depend on a number of loom settings of which shed timing appears to be the most important. Similar results can be achieved by high withdrawal tension and late shed crossing or by low withdrawal tension and early shed crossing.

There is no method which can be used in a mill for measuring the final tension, and so in the field of weft tension, we still have to a large extent, to rely on the personal judgment and skill of the overlooker. A weft unwinding tensiometer such as the Shirley instrument can be very valuable, however, in setting mean tension, and checking and reducing tension variations which occur from the beginning to end of a pirn and which give rise to various cloth faults.

Imports of Cotton and Rayon from China

Imports into the U.K. of cotton and rayon yarns and cloth from China are subject to quota restrictions. There is a home market quota to an annual value of £150,000 and a quota of £1·5 million for grey cloth for re-export after processing in the U.K. B.o.T. now announce that the quotas have been renewed for a further year to February 29, 1960. Details are given in Notice to Importers No. 897, issued by the Import Licensing Branch of the Board of Trade.

* * *

Acrylonitrile

A plant for the manufacture of acrylonitrile is being constructed by the I.C.I. General Chemicals Division at Cassel Works, Billingham. The plant, which will be the first large-scale unit of its kind in the U.K., is expected to go into production towards the end of this year. Acrylonitrile from the plant will be sold principally for the production of acrylic fibres. A smaller but expanding outlet is in the making of high impact-strength resins. Part of the output will be used within I.C.I. in the manufacture of the "Butakon" range of butadiene/acrylonitrile synthetic rubbers which have a high resistance to oil, heat, sunlight and abrasion.

* * *

British Chemical Plant for India

When the rayon plant of Travancore Rayons Ltd., was built after the late war, it was equipped by British engineering companies, mainly by Dobson and Barlow Ltd., Bolton, and Kestner Evaporator and Engineering Co. Ltd., designed and installed a special plant for the spinning bath acid recovery section, consisting of a climbing film evaporator and a complete crystallising installation for the recovery of glauber salts. The factory has been steadily expanding its capacity and is shipping a second evaporator to cope with the increased load. This is of the latest multitubular type and all parts coming in contact with the liquor and vapour are of "Keebush" (Kestner's own corrosion resistant plastic), the tubes and tube plates being in carbon. The new evaporator has a capacity of 2,900 lbs. of water evaporated per hour.

* * *

Courtaulds/Celanese Products

Courtaulds Marketing Division has now formed a Press Section to deal with press enquiries and supply information about the Courtaulds/Celanese products with which the Marketing Division deals, and about its sales promotion and advertising activities. This section will be located at 22 Hanover Square, London W.1. Matters of general publicity will continue to be handled by Mr. M. W. Pitts-Tucker and Mr. K. G. Hibbs at Courtaulds Ltd., 16 St. Martins-le-Grand, London E.C.1. (Tel.: MONarch 8811.)

TEXTILE MACHINERY and MILL EQUIPMENT NEWS

A Multi-Gauge Fully-Fashioned Machine

This new machine is a three-head model, each head being a different gauge and 30 ins. wide; the gauges may be three of the following : 18, 21, 24 *or* 27

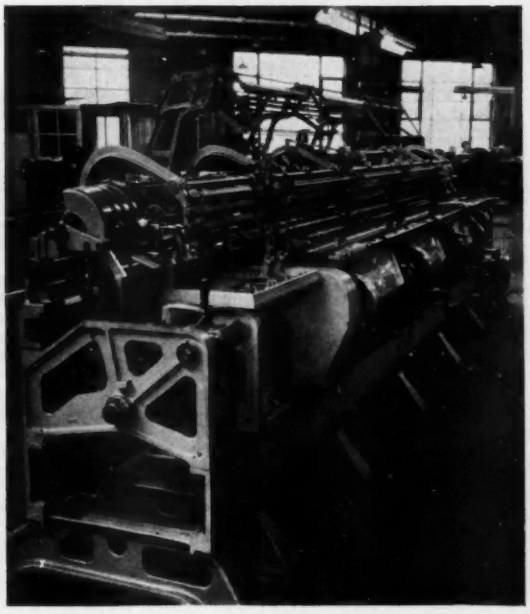
A RECENT addition to the range of machines made by S. A. Monk (Sutton-in-Ashfield) Ltd., is a multi-gauge fully-fashioned machine claimed to be ideally suited to sampling purposes. It will be of considerable interest to manufacturers employing a number of fully-fashioned outerwear machines, since it offers the facilities whereby all sampling could be carried out on this new multi-gauge model instead of interrupting the production flow from the main plant of machines.

As will be observed from the illustrations, the machine is a three-head model, each head being a different gauge and 30 ins. wide. The gauges may be three of the following: 18, 21, 24 or 27, and the machine has a fixed speed of 60 courses per minute. It is not intended that any automatic features be added, such as automatic rib transfer or welt turning, because the machine is not intended for production purposes.

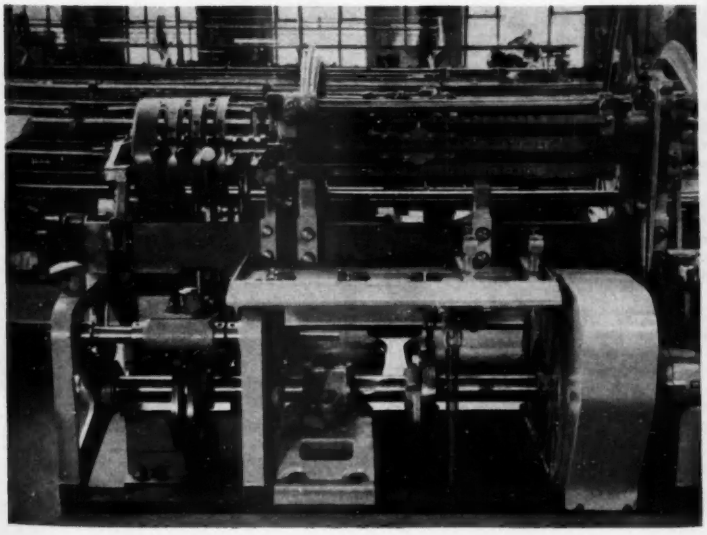
Cam motions and knitting elements are exactly like those of the firm's "Superspeed" and "Samcomatic" machine so that comparable fabric will be knitted. The multi-gauge machine has, however, a fixed draw for the purpose of simplification.

The system used for racking the screws during fashionings on a multi-gauge machine differs from that of orthodox machines in that the amount moved by the screw has to be adjusted for each gauge. This is done very simply by moving a selection lever at each end of the machine and engaging the checkwheel plunger for the gauge selected. For this reason, it is only possible to knit on one head at a time. It is also necessary to remove the fashioning fingers from the two heads not in use since the fingers on the two gauges not selected will not be positioned correctly to pass between the sinkers during a fashioning. In order to facilitate the replacement of these in their correct positions, they are butted up to pre-set gauge screws. The only other adjustment to be made to the machine when changing gauges is that of quality adjustment, all cam motions and element bar settings being the same for the range of gauges offered.

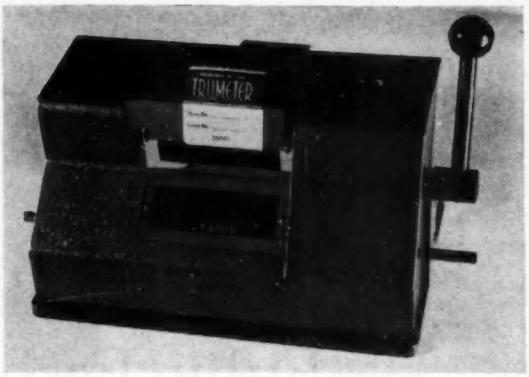
New 3-section multi-gauge machine for sampling purposes



Gauge selecting device on the new multi-gauge sampling machine



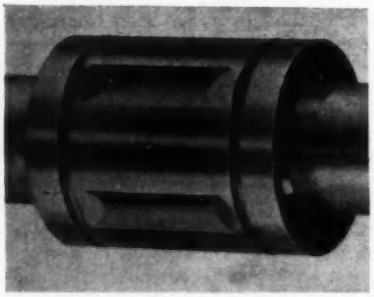
Counter with Instantaneous Printed Record



THE new Mark 2 printing counter made by Trumeter Co. Ltd., Milltown Street, Radcliffe, nr. Manchester, is now available in a variety of models. For use in counting and measuring many different products, it can be supplied mechanically driven by revolution or stroke movements, or electrically operated by impulses. Robustly constructed and designed for continuous working it is simple in operation. One movement of a lever re-sets the counter to zero, simultaneously printing the figures on to a ticket which is then ejected. A special storage unit ensures that records are "held" while the counter is being re-set or the printer is operating.

As seen from the illustration the instrument is fully enclosed and the case has a sloping front for easy reading. Available with 3 to 6 digits, the counter can be made fully automatic i.e., re-setting and printing by means of a small electric motor. Indicating numbers next to the printed result can be incorporated, to indicate either code number or letter.

Features in Precision-Built Ball Bushings

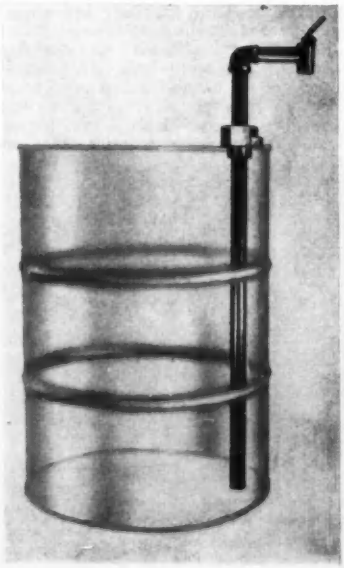


COMPACT and robust in construction the ball bushings now available from Ransome and Marles Bearing Co. Ltd., Newark-on-Trent, have several features of considerable interest to machine designers, mill engineers and other technical staff. Announcing the sole manufacturing and selling rights for Great Britain and the Commonwealth, excepting Canada, the company point out that precision linear motion is achieved by means of an ingenious but simple unit in which the steel balls recirculate just as in a conventional ball bearing. Each ball bushing forms a compact assembly which can be handled as a unit and chatter, loss of alignment, high maintenance costs, awkward assembly and wear are some of the problems solved by these bushings. As easy to fit as plain bearings these ball bushings offer precision linear motion at all times and their low co-efficient of friction is hardly affected by changes in load lubricant viscosity. Eleven shaft sizes are available ranging from $\frac{1}{4}$ to 4 ins., with corresponding outside diameters from $\frac{1}{2}$ to 6 ins.

New Automatic Barrel Dispenser

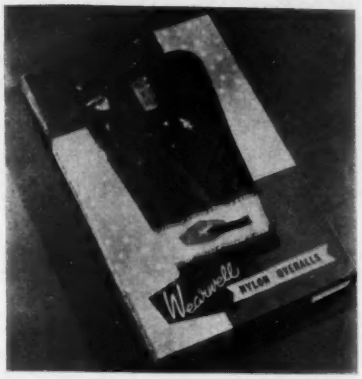
A NEW air-operated barrel dispenser —the Model 108, made by Suba Hydraulics, 142-4 Carshalton Road, Sutton, Surrey—is fully automatic in operation and required virtually no attention. It will deliver liquids at the rate of 15 galls./min., dependent on the type of vessel and the viscosity of the liquid. Easy to handle, the dispenser consists of a solid drawn steel tube riser pipe with aluminium valve body, air regulator body and barrel adaptor. The valves, stems and air regulator piston are made in brass, and the delivery valve is designed to give minimum drip after serving. The barrel adaptor on the standard model fits 2 ins. B.S.P. thread; the air regulator has a $\frac{1}{4}$ in. B.S.P. female thread.

The air control valve ensures that the storage vessel (40 gall. drum, etc.) is not subjected to more than 5 lbs./sq. in. pressure. In addition, an excess pressure safety valve is fitted to bleed away excess air pressure in the unlikely event of the air control valve not functioning. In operation, the barrel cap is opened, the dispenser screwed in and connected to an air supply. No priming is necessary and being pressure operated, it will deliver over long factory lines. Preventing expensive waste and the manhandling of heavy barrels, the dispenser does not require a continuous supply of air. Once charged, it will maintain its own pressure until an appreciable drop of level is reached.



Suba barrel dispenser

Overalls go Glamorous



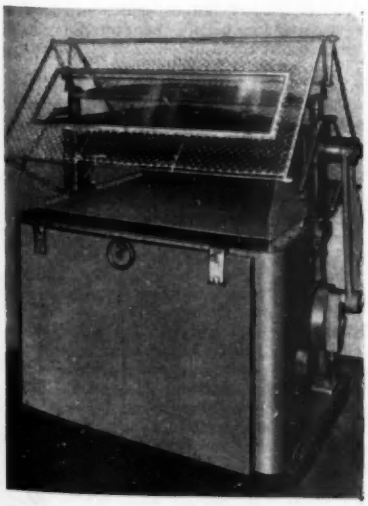
GLAMOUR-PACKAGING has been adopted by Wearwell Overall Co. Ltd., Birmingham, for their range of nylon overalls. The overalls, made in several attractive colours, are individually presented in sulphite-backed transparent "Cellophane" film bags, which keep them clean and neatly folded while allowing their colour, texture and style to be clearly seen.

Each bag is placed in a cardboard box, 11 × 17 ins., with a lift-off lid embodying a large, irregular-shaped, cellulose acetate film "window". The double layer of films gives the contents a high sheen and sparkle, while the box, printed in white and two tones of grey with information and promotional matter, contributes strength and rigidity. To ensure maximum visibility, printing on the bag has been kept to a minimum—simply a white panel, bearing the "Wearwell" logotype reversed on an orange background, and the word "overalls" reversed on black. Packaged in this way, the overalls are particularly suited to self-selection selling. The bags are made by Colodense Ltd., Bristol, and the boxes by Pazo Co. Ltd., Oldbury.

Featherweight Plastic Tote Boxes

KILBOURN MARTIN Ltd., Sanvey Gate, Leicester, have recently announced the development of a new type of plastic tote box. Constructed on similar lines to their well-known range of acrylic containers, the new models are claimed to be virtually unbreakable. Moulded from an improved, newly produced copolymer PVC, using an advanced technique on deep pressing, they are tougher, yet deeper than the acrylic types, with very even material flow. They are transparent, and entirely self-stacking. Their snag-proof washable finish eliminates damage to the finest of fabrics. Featherweight and easily carried. Although primarily intended for ladies' nylon hose storage/movement, they are equally suitable for many other uses.

Safety in Pattern Cutting



New pattern cutting machine

A NEW pattern-cutting machine has been produced by John T. Hardaker Ltd., Bowling Iron Works, Bradford.

The illustration shows the compact drive and the adequate guarding arrangements. Further details will be gladly supplied by the firm.

Completely power-driven, the machine is fully guarded to the requirements of H.M. Inspector of Factories. The drive is totally enclosed, and the wire top guard has a perspex panel to give the operator a clear view. The machine works only under a safety control, and cannot be started unless the operator has a hand to each starting button.

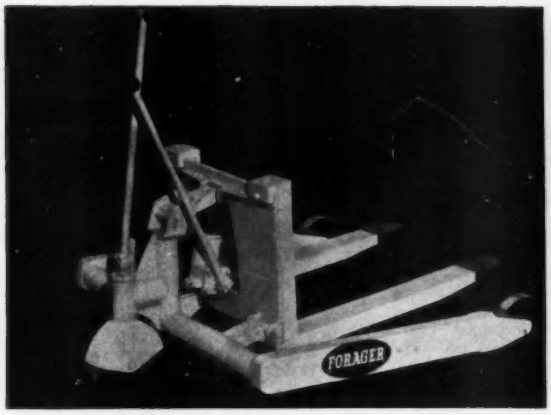
International Conference at Dusseldorf

"Women's Ready to Wear Clothing" is the subject of a conference organised by the International Rayon and Synthetic Fibres Committee, to be held at Dusseldorf, June 18 and 19. This date has been chosen to coincide with the Dusseldorf Ready to Wear Clothing Exhibition. M. D. Gorin, representing Chambre Syndicale de la Couture de Paris, the organisation behind the Paris Haute Couture, is to give the opening lecture, to be followed by papers on the technological aspects and organisation of work in the women's wear industry in the U.S.A. and Europe, the speakers being respectively Mr. Morton Glenn (David Chrystal Inc., New York) and Mr. E. Donner (general manager, Clothing Technical Institute of the Advanced Textile School of Munich). On the second day lectures will be given on distribution and sales promotion of women's ready to wear apparel in the U.S. and Germany. Dr. H. A. Thomas (Courtaulds' Marketing Division) will give the final technical lecture—"Rational Textile Blends for Women's Wear." Arrangements for British delegates to attend are being made by the London Office of the British Man-made Fibres Federation.

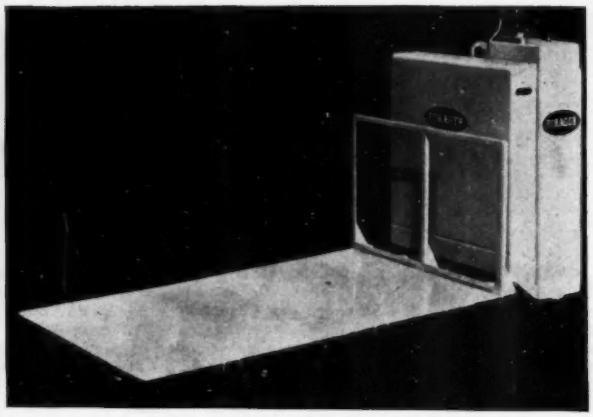
* * *

Changes of Address

The London office of Small and Parkes Ltd., Hendham Vale Works, Manchester 9, has been moved from 76 Victoria Street, S.W.1, to 251 Kingston Road, London, S.W.19. Small and Parkes's depot at 18 High Street, Wimbledon, S.W.19, has also been moved to 251 Kingston Road, S.W.19. The company's Chester depot has also been moved from 3/5 Lower Bridge Street, to 86 Westergate Street, Chester.



"Forager" hand pallet transporter, showing pump ram unit which operates the lifting gear



"Forager" 2,000 lbs. capacity battery electric platform truck. Platform size 60×30 ins.

Valuable Aids to Material Handling

THE first of two new "Forager" trucks announced by A. Hurst and Son Ltd., Crescent Works, Meadow Lane, Dewsbury, should prove invaluable to all concerned with pallet conveyancing in textiles. With a capacity of one ton, overall length 4 ft. 8½ ins. and overall width 3 ft. 8 ins., the Hand Pallet transporter is manufactured in various models to suit pallets from 30 ins. to 54 ins. wide. The lifting gear embodies a special pump ram unit ensuring an easy 3¾ ins., lift to the adjustable centre forks.

The second truck, a 2,000 lbs. capacity battery electric platform type, weighs 1,200 lbs. unladen, and has a platform measuring 60 ins. × 36 ins. Rear wheel steering is incorporated, giving 180° lock, whilst the three forward and three reverse speeds give 1½ m.p.h. to 4 m.p.h. Braking is effected by a particularly efficient transmission brake, operated by a control handle.

The chosen power unit is a 24 volt heavy duty traction motor powered by a 24 volt battery turning out 105 amp. hour at the five-hour rate, driving from the rear wheel through a heavy duty worm gearbox and duplex chain. Extremely neat in design and robust in construction these two new conveyors are capable of moving heavy loads with speed and maximum safety.

The Schule filter press

Filter Presses for Chemical and Textile Applications

DURHAM Raw Materials Ltd., 1 - 4 Great Tower Street, London, E.C.3, have been appointed sole selling agents in U.K. for the full range of filter presses manufactured by F. H. Schule Ltd., Hamburg 26, Germany. These can be supplied to standard patterns or tailor made to cover any filtration application, particularly in chemical, paint and varnish, oil, textile, etc., industries. Schule filter presses are of two basic types: (*a*) flush plate and frame presses, for use where the filter cake is of uniform thickness and porosity, and facilitates an effective flushing of the solids, and (*b*) recessed plate presses, for use where solids are subject to blockage. Both are available with plate sizes from 9¾ to 57 ins.

Light-Weight Press

Filter presses, bodies, plates and frames are manufactured in the materials most suitable for the intended application. Those most commonly used are close-grained cast iron, high quality steel and steel alloys, stainless steel, aluminium, copper, bronze, hard rubber and suitable woods. To resist corrosion or abrasion, filter plates and frames may be covered with protective coatings. Other special features which can be incorporated include: channels for circulation of steam or cooling agents, gas proof filter elements, and plates and frames for high filter pressures. A lightweight press is available for applications for which a maximum pressure of 45 lbs. p.s.i. is stipulated. A special laboratory press with a 5 ins. plate, fitted with "Plexiglass" frames and plates, is available to provide for visual control of the filtering and washing processes. The presses are supplied with either mechanical or hydraulic closing devices. The latter incorporate the Schule hydraulic spindle, which makes this form of closure possible without the use of pumps, valves, pipes, and liquid containers. This can be electrically controlled.

THE TEXTILE
COLOURIST & FINISHER

The Crease-Resisting Process

The Triazone Compounds

Some of the manifold possible variations on the fundamental triazone structure may prove to be of greater benefit than the compounds at present available.

By J. T. MARSH, M.SC., F.R.I.C., F.T.I., F.S.D.C.

FOR many years the two chief resins which have been employed for the crease-resisting finish depend on either dimethylol urea or a methylol melamine product. Dimethylol urea is quite simple to make and is very widely applied; it forms the well-known thermosetting resin, for although it contains only two reactive methylol groups there are actually four reactive points, namely, two hydroxyl groups and two imino-hydrogens (Fig. 1). Chemical reaction

Fig. 1. Dimethylol urea

does not proceed to completion so that the final treated fabric contains a resin with some imino-groups which are free to absorb chlorine from solutions of hypochlorite.

Melamine, on the other hand, contains three amino-groups in which all the hydrogens are replaceable by methoxyl (- CH_2OH) thus providing the possibility of a resin which contains fewer free imino-groups than that from dimethylol-urea; hence the affinity for chlorine is much lower (Fig. 2).

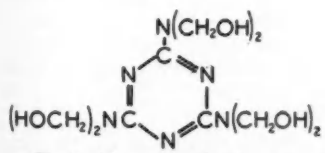


Fig. 2. Hexamethylol melamine

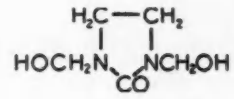
In actual fact, the affinity for chlorine is only part of the story; the imino-chlorides produced will form hydrochloric acid on heating and this free acid will damage the cotton or rayon fabrics. The chlorine-retention-damage damage, as it is termed, is much greater in fabrics treated with dimethylol-urea than in those treated with methylol-melamine, partly because the amount of chlorine is much lower in the products containing melamine, and partly because melamine is much more basic than urea, so that the imino-chloride does not produce hydrochloric acid so readily.

Unfortunately, fabrics treated with melamine-formaldehyde become slightly yellowed when placed in hypochlorite solutions and this discolouration increases on subsequent ironing; commercial laundries have means of removing this discolouration but they are not available to the average housewife including those who may be unwise enough to use hypochlorite solutions for home laundering. Commercial laundries can also remove any combined chlorine from goods treated with either urea-formaldehyde or melamine-formaldehyde.

The reason for the yellow discolouration of melamine-formaldehyde in hypochlorite solutions is not known with any certainty. For many years, however, the minor disadvantages of urea-formaldehyde and melamine-formaldehyde in this particular respect were not considered very serious, for the general public was very cautious in the use of hypochlorite solutions in the home.

The rise of the drip-dry cottons in 1954, particularly in the U.S.A., was accompanied by a demand for white goods which would not be damaged by acid or yellowed by the use of hypochlorite in the laundry; in certain respects, there was criticism of both urea-formaldehyde and melamine-formaldehyde, but the introduction of dimethylol-ethylene-urea was an attempt to meet the new requirements (Fig. 3).

Fig. 3. Dimethylol-ethylene-urea



From its formula, DMEU contains no imino-hydrogens so that the affinity for chlorine is negligible.

After several years of application, some doubts began to be raised in connection with the stability of the treated product and it was found that certain precautions were necessary which were not previously known; furthermore, there were difficulties with commercial laundering when some degradation could take place under alkaline conditions but more noticeably during acid souring at pH 3·5. Fears began to be expressed as to the wisdom of the widespread use of DMEU even though in theory it should be immune to chlorine-retention-damage, and during 1958 there has been a rather rapid turning away towards other and newer types of finishing agent. Ethylene-urea products, however, are still commonly used and it must not be thought that they are back-numbers, for many finishers are able to use them with great success.

Triazones

The first type of product belonging to the class of triazones or tetrahydro-5-alkyl-s-triazin-2-one was actually a thio-compound (tetrahydro-s-triazin-2-thione) which was synthesised by Nencki (Ber., 1874, **7**, 158), but in 1933 the preparation of 4:6-disubstituted-tetrahydro-s-triazin-2-ones was described by Steindorf and Paquin in D.R.P. 582,203, followed by U.S.P. 2,016,521 in 1935.

The more recent type of compound, substituted in the 5-position, was described by Burke in 1940-42 (U.S.P. 2,304,624) with particular reference to 5-hydroxyethyl-tetrahydro-s-triazin-2-one; although the methylol derivatives were not mentioned, a series of alkoxymethyl derivatives of the triazones was the subject of a later patent (U.S.P. 2,321,989). The triazones are easily made in a single step from inexpensive materials, such as an aliphatic amine, an aldehyde, and urea.

A typical example is to add the aliphatic amine to dimethylol urea solution and allow the reagents to react for 1 hour at 100°C. or for 24 hours at room temperatures. The excess of water may be removed, if necessary by distillation under reduced pressure, and the triazone purified by crystallisation. Tetrahydro-5-methyl-2(1)-triazone melts at 210°C. and the corresponding isobutyl derivative melts at 200°C. (Fig. 4).

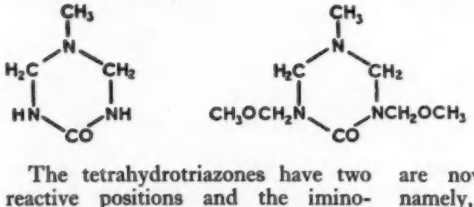


Fig. 4

The tetrahydrotriazones have two reactive positions and the imino-hydrogens may be replaced by methylol groups, but as the resulting compound is unstable to heat, it seems preferable to treat with an alcohol to make the *bis*-alkoxy-methyl-tetrahydrotriazone as shown above (U.S.P. 2,321,989).

Burke described some twenty compounds of this class, and it appears that Paquin (Angew. Chem. A., 1948, **60**, 267) was working on somewhat similar lines for the I.G. in 1942-44. There seems to be no patent here until D.B.P. 859,018 of 1952.

A simple method of preparation is to treat urea with an aldehyde-ammonia compound to produce a triazine, which nevertheless may still be included in the class of trimethylene triamines. American terminology uses "triazone" which one assumes is a shortened form of triazinone. (Fig. 5).

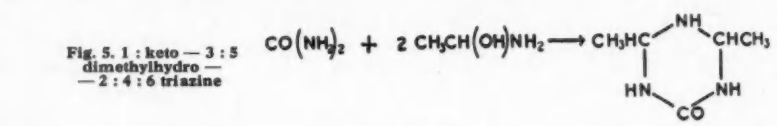


Fig. 5. 1 : keto — 3 : 5 dimethylhydro — — 2 : 4 : 6 triazine

This is an interesting compound which can form a trimethylol derivative which presumably will react to make a thermosetting resin. Most of the compounds described by Paquin, however, are similar to those made independently by Burke, but there is mention of the use of guanidine nitrate instead of urea in the reaction with acetaldehyde-ammonia to give a compound in which the oxygen of the keto-group is replaced by imino.

In the general method of condensing urea, aldehyde and amines there are many possible variations and some 24 compounds are described. For example, urea may be dissolved in a solution of methylamine with warming and stirring and then cooled; formaldehyde solution is then added and the liquid maintained at 55 to 60°C. for an hour. Drying in vacuo produces the 1-keto-4-methylhydro-2:4:6-triazine which is identical with the tetrahydro-5-methyl-2(1)-triazone of Burke mentioned previously. It may also be called 1-keto-4-methyl-trimethylene-triamine, and this is perhaps a useful way of regarding those members of the triazones which are now so popular in America, namely, 1-keto-4-alkyl-trimethylene-triamine (Fig. 6). They will condense

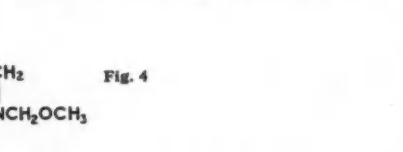


Fig. 6

with formaldehyde to give dimethylol derivatives, but as these are only bifunctional they act as cross-linking agents and do not form thermosetting resins and three-dimensional networks. In this respect they resemble the cyclic ethylene ureas or imidazolidones (Fig. 7). These bifunctional reagents

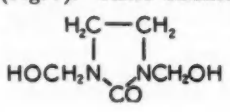


Fig. 7

can only form linear polymers, or thermoplastic resins, when condensed with themselves; in presence of cellulose they exhibit a greater tendency to act as cross-linking agents with cellulose than to combine with themselves; hence they are efficient and economic in comparison with urea-formaldehyde or melamine formaldehyde, in the field of crease-resisting and no-iron finishes.

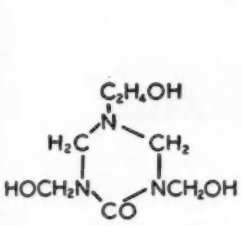
Not only are the triazones easy to prepare from simple reagents, but they have an advantage over the imidazolidones, or cyclic ethylene ureas, in that it is possible to vary the nature of the alkyl substituent (*R*) methyl, ethyl, propyl, butyl, etc., and so vary the basicity of the triazone; this adds a new dimension or a fresh factor to the chemistry of resinous condensation products employed in textile finishes. It is therefore possible to have compounds which are strongly basic and will not liberate hydrochloric acid on ironing after the treated goods have been subjected to hypochlorite during laundering; some organic bases are strongly alkaline, much more so than sodium hydroxide, for they are capable of dissolving cellulose; hence it is possible for the amine-salt to be as resistant as common salt.

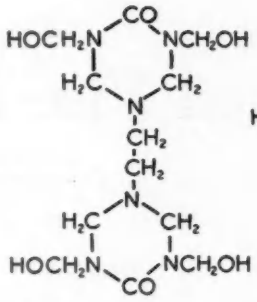
Typical trade products are Warcoset LCR, Onyx U-4, Prym CR, Stanset 120 and Stanset Z 98. In general it seems that the ethyl group is preferred in the reacting aliphatic amine, but the field of the new products also includes the hydroxyethyl triazone obtained from ethanolamine.

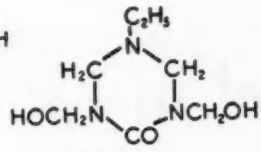
It is also possible to use ethylene diamine as the base in the preparation of the triazone and so produce a more complicated structure (Fig. 8).

As previously stated, the nomenclature is apt to be very confusing, and sometimes inaccurate, but some form of simple name is highly desirable, particularly for use in the finishing works. The triazones are also familiarly termed amine-modified cyclic ethylene ureas, and sometimes the amine resins; both the triazones and the imidazolidones may be called cyclic ureas which affords scope for additional confusion.

The most popular of the triazones in use at present is the dimethylol ethyl triazone or more correctly dimethylol tetrahydro-5-ethyl-s-triazin-2-one (Fig. 9).







(above) Fig. 9 Dimethylol ethyl triazone

(left) Fig. 8

As previously indicated DMET is readily prepared by treating dimethylol urea with ethylamine; the commercial product is not generally purified so that certain precautions have to be taken in actual use. Some free amine is present and this tends to neutralise some of the acid catalyst, which has also to deal with a compound which is more basic than either urea-formaldehyde or dimethylol ethylene urea; hence the amount of catalyst is about 12% based on the weight of the triazone.

The free amine has also to be removed after the final condensation or there will be a strong fishy odour and a tendency to discolour on ironing; a sequence of stages in the essential final wash includes 2% sodium perborate at 50°C. in which the fabric is padded and allowed to lie for 20 to 30 mins., followed by an open soaping system of about six compartments, the first two of which contain 0·25% sodium perborate, 0·25% soda ash and 0·1% of a suitable wetting agent, whilst the remainder are used for rinsing, all at 50 to 60°C., so that the goods finish at pH 6·5 to 7·5.

Another feature of the treatment with triazones is the necessity for a "hard cure," e.g. for 2 to 3 mins. at 150°C. or 1 to 2 mins. at 165°C., higher temperatures tend to produce discolouration and it is frequently recommended that the finisher should conduct preliminary trials to establish the optimum conditions for minimum discolouration and maximum durability.

Commercial DMET usually contains some free dimethylol urea in addition to the free amine; the presence of the former undoubtedly helps with the final crease-recovery, for the pure compounds do not give such good recovery figures as the commercial products, as shown by Reid and his colleagues of the Southern Regional Research Laboratory (Am. Dyes. Rep., 1958, **47**, 758).

Wayland (Chemical Finishing Conference, Washington, October, 1958) has also found that the commercial triazones vary greatly in composition; some of them are practically pure whilst others contain an equimolecular ratio of dimethylol urea. The latter are by no means inferior in actual use for damage is prevented by the buffering action of the triazone; the presence of dimethylol urea improves the crease-resisting effect and avoids the necessity for a hard curing treatment and so reduces the discolouration which otherwise is likely to occur.

Reid and his colleagues have reported on the performance of three triazones (AATCC, Chicago, October 1958), namely the dimethylol derivatives of ethyl triazone, hydroxy ethyl triazone, and the tetramethylol derivative of ethylene-bis-triazone; the latter was made with ethylene diamine as the amine. For the actual treatment, an 8% solution was used so as to give about 3·6 to 4% of added weight on the fabric; zinc nitrate was used as the curing catalyst amounting to 0·5% in the impregnating bath.

In general it was found that the trizones gave poorer crease-recovery than other resin treatments, and furthermore, their durability was not as good as that from either melamine-formaldehyde or ethylene-urea-formaldehyde.

The chief claim for superior results with triazones is on the grounds of resistance to damage by hypochlorite bleach during laundering, for the tertiary amine group of the triazone neutralises the acid formed from the retained chlorine and so prevents degradation of the fabric; furthermore the salt formed is decomposed during alkaline washing, so that the tertiary amine group is regenerated to take up acid again when necessary.

Melamine-formaldehyde finishes suffer little loss in strength but the fabric becomes yellow; urea-formaldehyde, on the other hand, generally suffers a severe loss in strength. The triazones are undoubtedly superior in respect of resistance to damage due to chlorine, with the exception of the tetramethylol-ethylene-bis-triazone.

Although dimethylol-ethylene-urea absorbs less chlorine than dimethylol-ethyl-triazone, it is rather susceptible to the hydrolytic action of acid below pH 5 during the souring process, and there is some decomposition which results in a sensitivity to chlorine-retention-damage through an increased affinity for chlorine.

In connection with the general physical properties of cotton cloths treated with DMET, the losses in strength and resistance to abrasion are similar to those encountered with other resins for approximately the same degree of crease-recovery. For the textile chemist, the triazones are full of interest and bring important new information to the whole field of crease-resisting and smooth-drying fabrics; there can be no doubt that they have provided a very useful contribution to the chemistry of the subject. Many textile finishers, however, are less enthusiastic about them at the end of 1958 than they were at the beginning of the year, possibly because they had been led to expect too much.

There is no doubt whatsoever that the triazones are very efficient in suppressing chlorine-retention-damage, but this is only one of several important factors in smooth-drying fabrics. Those American finishers who are accustomed to omitting the final wash are not well pleased with the prospect of the necessity of a prolonged and severe washing stage; moreover, the risks of the unpleasant fishy smell in the goods and the possibility of yellowing at high temperatures have to be faced. The more skilful and experienced finishers may be able successfully to steer the narrow way between an adequate cure for good recovery and a more drastic cure with the risk of some discolouration. The durability of the effect is also in question compared with other methods of treatment.

At the moment, therefore, it seems that there will be a tendency for many finishers to approach the use of triazone finishing agents with considerable caution, and to avoid the risk of chlorine-retention-damage by adopting other measures. In the future, however, some of the manifold possible variations on the fundamental triazone structure may prove to be of greater benefit than the compounds at present available and because of their inherent chemical potentialities, this new class of finishing agents should not be dismissed altogether.

'Terylene' in Lined Fire Hose*

Easy to look after, this type of hose dries quickly and is not subject to rot or mildew

AFTER many years of extensive research Jonsereds Fabriker A/B have introduced a new type of fire hose made entirely from "Terylene" and lined with p.v.c. This hose has been tested by the Civil Defence Authorities, and many Swedish fire brigades have expressed great satisfaction with it.

One must distinguish between two main types of fire hose, lined and unlined. Both types are woven, usually on circular looms, the principal difference being that a lined hose has an inner coating of watertight rubber or p.v.c. Unlined hose becomes watertight through the swelling of the textile material used, when the hose becomes wet, and only textile fibres with a considerable swelling ability, notably flax and hemp, are suitable for this type of hose.

In a lined hose conditions are rather different. The water is contained within the impermeable lining, and the fibres of which the hose jacket is composed are prevented from becoming wet from the inside, so that their capacity to swell is no longer important. The hose lining itself has virtually no strength, acting only as a barrer to the water, so that the jacket must still be strong enough to withstand water pressure without distortion. It should also have good resistance to abrasion and to rotting, whilst flexibility and lightness are equally important properties.

Fibre Properties

Table 1 shows that synthetic fibres possess very high strength in comparison with the natural fibres formerly used for fire hose manufacture, flax being the only serious contender. The low extensibility of the natural fibres, once considered an advantage, is now regarded as a drawback. It has been proved that the slighter higher extensibility of fire hose made from polyester fibre has certain real advantages, notably better resistance to shock pressure and to freezing, and harder wearing properties. The very high extensibility of nylon, on the other hand, can be a disadvantage, as too high an extension in both warp and weft directions may cause "snaking" of the hose and excessive wear at the couplings and may be detrimental to the inner tubing. The synthetic fibres also have an advantage in their low specific gravity and low moisture uptake, as a fire hose made from synthetic fibre will consequently be lighter in weight and easier to handle when wet.

Table 1

Fibre	Tensile strength kos./sq. mm.	Wet strength vs dry strength %	Residual strength after 20 days at 130°C.	Extension at break conditioned state	Moisture content in % of dry weight at 95° R.H.
"Terylene" HT ..	75 - 87	100	95	12·5 - 7·5	0·5
Nylon HT	76	90	21	19·0 - 15·0	ca 8
Flax..	69 - 77	120 - 130	24	2·8 - 3·3	19 - 23
Ramie	41 - 96	ca 130	12	4·5	20 - 26
Cotton	41 - 68	105 - 110	38	7·3	24 - 27
Viscose fil. ..	41 - 55	60 - 70	44	20·0 - 9·0	27 - 35

Hose Construction

The strength of a fire hose is normally decided by the weft component, the warp lying more on the surface and serving as protection. Upon the weft yarn will depend the bursting pressure of the hose, and a strong fibre is therefore essential. The use of spun yarns necessitates very coarse counts, and the hose becomes stiff and awkward to handle Cotton is therefore not a good choice for the weft yarn of the fire hose, whilst a synthetic filament yarn meets the requirements admirably. The warp yarn must have good abrasion resistance and covering ability, and for this reason spun synthetic yarns are often used. The structure of the warp will also affect the flexibility of the hose and the adhesion of the textile jackets to the lining. The weave is also important, a twill giving more flexibility than a plain weave but less abrasion resistance.

The adhesion between inner and outer layer is, of course, of the first importance. Natural fibres do not offer any difficulties; both p.v.c. and rubber can be bonded easily to the outer jacket. Synthetic fibres, on the other hand, particularly the filament types, are more difficult to handle, but satisfactory adhesion can be obtained by using the special methods that have been developed. Rubber linings have the merit of great flexibility, but their ageing properties are relatively poor, and they have a low resistance to oil. P.v.c. linings are usually made from plasticised p.v.c. Here it is imperative to use first class plasticisers, to obtain a sufficiently soft tube and to give good ageing properties. The oldest method of bonding the jacket and lining together, still widely used nowadays, is to glue the ready made tube to the textile jacket. A more modern method is to vulcanise the inner tube to the hose or to pump a latex solution through the textile jacket.

Comparison Between Various Types of Fire Hose

Until recently all the hose used in Sweden was unlined, whereas in the U.S.A. and elsewhere in Europe lined hose was normally preferred. The reason for the popularity of unlined hose in Sweden is that the lined hose made from natural fibres proved considerably heavier and more difficult to handle. This consideration was particularly important in a sparsely populated country like Sweden, where the fire brigade might have to transport the hose over long distances. The position changed with the advent of the new lined hose made from synthetic fibres. The weight and storage space required were about the same as for unlined hose, whilst the

* *This article is a shortened and translated version of a paper contributed to the Swedish magazine "Plastvärlden," by Dr. N. B. Furvik and civil engineer, U. Boman, of Jonsereds Fabriker A/B, Sweden, and reproduced by the authors' kind permission.*

lined variety has the following positive advantages to offer:—

(1) It is water tight. Water damage and leaking losses are greatly reduced.

(2) The friction in the hose is considerably lower, and it is therefore possible to increase the water flow.

(3) The new hose weighs less when wet and is quicker to dry.

(4) There is no danger of damage from rot or mildew.

The following paragraphs are based in part upon the results of recent German work on lined hose (notably A. Kruger's reports for the Forschungsstelle für Feuerlöschtechnik, Karlsruhe) and partly upon the authors' own observations.

Bursting Pressure

Swedish fire brigade and civil defence regulations require that a 38 mm. fire hose must be able to stand a pressure of 45 kilos/sq. cm. (coarser dimensions 35 kilos/sq. cm.). These bursting pressure figures must be obtained after 20 cycles of pressure variation between 0 and 40 respectively 30 kilos/sq. cm. These requirements are difficult to meet with a natural fibre wefted hose without making it too stiff and awkward to use. On the other hand, it is difficult to meet the existing claims on limited extensibility with a fire hose made from polyamide fibre.

Resistance to Light, Heat and Mildew

Both outdoor tests and fadometer tests prove that polyester fibre hose shows less degradation from sunlight, less even than hemp and flax, whilst nylon and perlon hose degrades rapidly. It has also been shown that polyester fibres have the best resistance to dry heat up to 200°C. Investigations in Germany into the resistance offered by various types of fire hose to heat, to radiation and to open flame revealed that polyamide hoses were inferior to all the others.

One of the most interesting and valuable properties of synthetic fibre hose is its immunity to rotting and mildew. Natural fibres have to be proofed against rot and mildew attack, and there is always the danger that this proofing will be removed eventually by water. The same problem arises with hoses made partly from synthetic and partly from natural fibres.

Industrial Hose

The polyamide, and above all the polyester, fibres, are superior to the natural fibres in their resistance to chemical attack. Concentrated strong acids, such as battery acid, will attack the polyamide fibres, whereas the polyester can boast much better acid resistance. Practically all types of hose will resist diluted alkalis, and the polyester fibres are outstanding where oxidation agents are concerned. It is worth noting that for industrial fire hose du Pont recommend only polyester fibre.

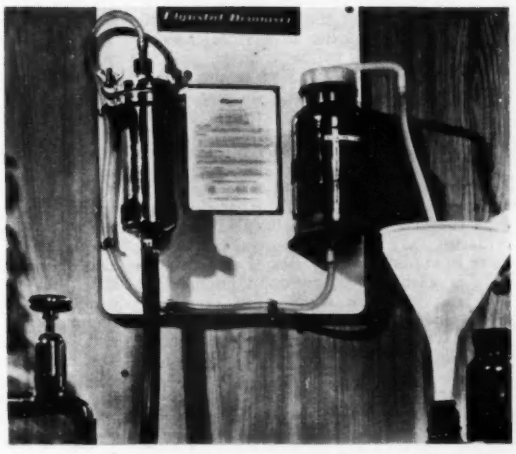
It is very difficult to determine adequately the abrasion resistance of a fire hose, and contradictory results have been obtained from laboratory experiments in various countries. According to du Pont's tests, for instance, a polyester hose is seven times better than cotton hose, whilst the official Government testing laboratories in Sweden found cotton to be superior in abrasion resistance to both polyester fibre and perlon! It is a fact that certain lab. tests have shown that "Terylene" and nylon have lower abrasion resistance than some of the natural fibres, whereas practical wear tests have proved them to be far superior.

Conclusion

We maintain that from practical experience synthetic fire hose has proved itself markedly superior to fire hose made from natural fibre. A "Terylene" fire hose is easy to look after, it dries quickly, it is not subject to rot or mildew. It follows that a hose of this type requires less maintenance and stock keeping, yet performs more efficiently. Greater ease of maintenance is particularly valuable in cases where there is no specially trained crew available and no suitable drying accommodation. In many industrial fields too the greater chemical resistance of synthetic fire hose has meant considerable saving in costs.

Bacteria-free De-ionised Water

THE Elgastat De-ioniser, Type B.110, made by Elga Products Ltd., Ion Exchange Division, Railway Place, London, S.W.19, is designed specifically for the provision of purified water. In operation tap water passes through the bacterial filter and through the transparent nylon cartridge containing the mixed exchangers. Deionised water is collected from the cartridge outlet. The resins embody a colour indicator. When fresh, the Elgalite resins are dark blue; as exhaustion proceeds, their colour changes to yellow, starting from the base. Thus, the colour acts as a capacity indicator. When the yellow colour has reached the exhaustion line on the cartridge the resins are exhausted. The cartridge is then exchanged within a few seconds for a freshly regenerated one. No regeneration in situ is necessary. The company's cartridge service applies to this unit. It is of considerable interest in laboratories where a small quantity of bacteria-free conductivity water is needed occasionally.



The B.110 de-ioniser is specially designed for the provision of purified water

Textile Institute Conference

Detergents, Textiles and Colour

OPENING a one-day conference on the subject of "Detergents, Textiles and Colour" held recently in Manchester, Mr. R. Thomas, M.A. (director, Calico Printers' Association Ltd., and a member of the Branded Textiles Group) said it was some 2½ years since the Group first began to agitate about the problem posed by modern detergents. They had interviews with most of the large detergent manufacturers, and he summarised the replies to the Group's allegations as (*a*) not true, (*b*) if true, not really important, (*c*) if important, we cannot do anything about it, (*d*) if we can do anything about it, we cannot afford to do anything about it!

There was plenty of evidence that housewives are beginning to get concerned about complexites largely unexplained to them. The problem facing the textile industry was that more and more housewives might start writing their M.P's and might persuade, possibly, the next Government to start legislation which, instead of telling them what they could not do, would begin to tell them what they must do. That, he thought, was not a good thing for anyone represented at the conference or for the country as a whole.

The first lecture was "The Problem from the Point of View of the Textile Manufacturer," by Mr. C. F. Ward, M.Sc., F.R.I.C., F.T.I. (W. E. Saxby (Nottingham) Ltd.) on behalf of the Branded Textiles Group. This was followed by a paper on "The Problem from the Point of View of the Manufacturer of Detergents," by Mr. F. P. Thompson, M.Sc., Tech., A.R.I.C. (Unilever Ltd.) and "The Problems of the Dye Manufacturer"—the last of the three papers to be given during the morning session—was by Mr. G. S. J. White, M.A., F.T.I., F.S.D.C. (I.C.I. Ltd., Dyestuffs Division). Presiding at the morning session was Dr. R. R. Lyne, B.Sc., Ph.D., F.R.I.C. (I.C.I. Ltd., Fibres Division). At the afternoon session Mr. A. F. W. Coulson, B.Sc., F.T.I. (R. Greg and Co. Ltd.), a vice-president of the Textile Institute and honorary treasurer, presided, at a discussion initiated by Dr. A. S. C. Lawrence, D.Sc., Ph.D., F.R.I.C. (Department of Chemistry, University of Sheffield).

Point of View of the Textile Manufacturer

"IN this paper, presented on behalf of the Branded Textiles Group, it is sought to focus attention not on the already well-known and widely advertised virtues of modern detergents but on some of their less desirable properties, and to air, so to speak, some of the complaints which have become all too familiar to those manufacturers of textiles whose products have been damaged in the process of washing," said Mr. C. F. Ward, M.Sc., F.R.I.C., F.T.I. "In doing so, it is not intended to suggest that the almost magical powers claimed for the various brands of detergents do not exist, or that detergents have not proved to be a boon and a blessing to housewives. Such a suggestion would be quite contrary to the facts. Nevertheless, like many other recent innovations of a domestic character, detergents are not entirely unmixed blessings, and it is felt that sufficient experience in their use has not been gained to make it worthwhile to draw attention to their defects. It is hoped that this friendly criticism may result in something being done to eradicate the causes of complaint.

It is a matter of common knowledge that the immense advance in scientific achievement and technological progress in the years since the war have resulted, *inter alia*, in the appearance of many new products which have well nigh revolutionised domestic life in this country. This radical change is now here more apparent then in the realm of textiles, where entirely new fibres and fabrics have appeared in bewildering succession, together with a variety of new finishes for application to textiles, both old and new, designed to improve their function and appearance. It is unnecessary to enumerate all the many discoveries and developments which have so recently taken place, even were there time to do so, but mention should be made of such characteristics as dimensional stability covering shrinkage resistance in wool, non-iron or easy-care fabrics among the cellulose fibres, and permanent pleating in the man-made fibres group.

These new fabrics could be dyed in a wide variety of fast colours ranging from the neutral dyeing dye on wool to the reactive dyes on cellulosic materials and the basic colours for the acrylic fibres. These were, of course, in addition to long standing and still widely used dyes of remarkable fastness to light, washing, and many other conditions. Fortunately, in the midst of all this change, the emphasis had been placed more and more on quality and on producing goods not only attractive but also thoroughly serviceable and dependable. As a result, good quality textile products of every description could now be bought by even those of slender means, and the housewife who avoided the obviously shoddy goods was entitled to expect that garments or household textiles she bought would give reasonably long service and would not undergo any radical change in appearance while in use.

Similarly, the manufacturer of good quality textile merchandise should be able to rest assured that the shirt, pullover, towel or whatever he made, would not show any substantial deterioration in quality or alteration in appearance after it got to the customer. An even more welcome change had taken place in the domestic laundering of textiles. The laborious hand wash involving endless rubbing, soaping and boiling was largely a thing of the past, thanks to the development of two distinct yet complementary aids to the housewife. One was, of course, the washing machine the other could loosely be described as the detergent, by which is meant all the various flakes, powders and liquids offered to the public. These various detergents, used to a greater or less extent by the vast majority of housewives, were manufactured with two main objects in view: (*a*) to facilitate and make more efficient the removal of "soil," and (*b*) to produce in white articles a most attractive finish by the use of "optical whites" or "fluorescent whites."

It is to examine the effect which constant subjection to washing in detergents is having on textiles that the Textile Institute has convened this conference, it being very much in the interests of the textile industry to ensure that washing preparations are free from any component which may damage textile products.

As a first step in this examination, it will probably be helpful to indicate what should be expected from any washing materials offered to the public, and it is suggested that both the ordinary user and the textile manufacturer can reasonably expect a detergent to fulfil the following basic requirements.

(1) It must remove "dirt" or "soil."
(2) It must be reasonably stable to hard water.
(3) It must not chemically attack the material being washed, especially in a manner which will reduce strength or otherwise shorten the useful life of the article.

(4) It must not, when used according to the instructions, produce any undesirable effect in the appearance of the fabric, such as a change of shade. This was not an attempt to put the onus for every colour change or migration in the wash, no matter how badly or carelessly the articles had been treated, on to the detergent makers.

People who washed garments dyed with non-fast colours against the advice given on the packets or bottles, or dried such garments under unsuitable conditions had only themselves to blame if the results were unfortunate. But provided the laundry process was sound and conformed with the detergent manufacturer's instructions, detergents should not, as unfortunately they frequently did, change a pastel peach shade to a crude pink, or a delicate nil green to either a dirty sky blue or grey.

Prior to 1940, the main detergent used in home washing was soap made from natural fats. The sodium salts of the fatty acids derived from these fats had very good dirt removing and suspending powers, and the various requirements of detergency could be catered for by juggling with that mysterious entity beloved of soap makers known as the "fat-charge." The first real change took place when soap powders were introduced containing additions of alkalies and, in one or two cases, oxygen liberating compounds or "per"-salts. These products did good service and still do in many cases, in spite of their sensitivity to hard water. The whites were improved in appearance by the judicious use of the blue bag and there were soaps and powders which contained small quantities of ultramarine as a harmless blueing ingredient. Subsequently, and as a consequence of (*a*) the production of synthetic detergents made from oil and its by-products and (*b*) extensive research into the nature of detergents, a wide range of laundering products appeared, all of which had their attractions for the housewife.

The chemicals used to make these products fell into several well-defined groups summarised as (*a*) basic detergents, (*b*) builders, (*c*) suspending agents, (*d*) chemical bleaching agents and (*e*) "optical" bleaching agents. It was understood that all the components mentioned in groups (*a*), (*b*) and (*c*) would be fully discussed in subsequent papers.

Optical Bleaching Agents

The name given to optical bleaching agents was a fairly clear indication of their function. It was well known that washing tended to cause yellowing of material, but that if a small quantity of a blue substance could be uniformly distributed over the textile being washed, particularly in the case of a cotton material, not only was the yellowing offset but a much improved whiteness was obtained. It was normal practice in the old days for housewives to add a blueing agent. A small quantity of such a pigment would rapidly diffuse through the water in the rinsing vessel and when the articles being washed were agitated, a certain amount of pigment was taken up by the fibres, particularly if starch were present. On drying and ironing the fabric assumed a brilliant and attractive whiteness regarded as the criterion of good laundering. Unfortunately, this blue pigment was not permanently fixed to the fabric.

To produce a permanent effect scientists turned their attention to the phenomenon known as fluorescence. Many substances reacted in various degrees to ultra-violet rays with varying results, but the chemicals used to produce the effect with which they were concerned were those which could absorb the invisible ultra-violet radiation and re-emit it as a visible blue light. This was one aspect of the effect called fluorescence. Chemicals which could be absorbed by textiles had been developed and were now in general use as components of most detergents for the purpose of producing the brilliant white finish which the public had come to expect. These "optical bleaching agents" had the property of being absorbed by textiles from ordinary washing solutions and could thus be automatically applied afresh each time an article is washed.

Within limits, the existence and use of optical bleaching agents was far from being unacceptable to the textile trade, continued Mr. Ward. Indeed, many uses were found for them in the manufacture of certain textiles where the deliberate and controlled application of "optical whites" was widely practised. Many of the finishes now being applied to white fabrics by the manufacturers contain fluorescers and it must be admitted that this practice gave rise to complications when such fabrics were washed in the home. In the first place, a fabric treated with a fluorescent finish, e.g., a sheet, tended to fade and lose its snowy look unless it was periodically washed with detergent containing an optical bleaching agent.

A second and more serious complication arose from the fact that these fluorescent substances could and did transfer themselves in the course of laundering from the fabrics to which they were originally fixed to any other article which might be in the washtub or washing machine with them. If those other articles happened to be of a delicate pastel shade they would probably emerge from the communal wash looking quite different from when they went in. Thus, finishes containing fluorescent agents, though they undoubtedly enhanced the appearance of white fabrics, had distinct drawbacks inasmuch as they needed periodic reinforcement if they were not to fade away, and fabrics so treated must be washed separately if damage to coloured articles was to be avoided.

These complications were caused by the widespread use of such finishes by textile manufacturers, and it was not suggested that there was anything that the makers of detergents could do about them. There was little doubt that for white fabrics the detergent-cum-optical bleaching agent was just what the housewife wanted, and were she to confine her laundry activities to whites only there would be no trouble at all as far as colour changes were concerned. As it was, a proportion of the articles washed at home were coloured and the effect of optical bleaching agents on such articles was often far from welcome. The same detergent which imparted a sparkling whiteness to a sheet would turn a pale peach towel into a bright pink one. Similarly, a pale green took on a blue tone and a blue, subjected to the same treatment, became a reddish grey. Such changes were unavoidable in the course of ordinary well-conducted washing with most, if not all, the well-known detergents on the market, and the housewife who used one or other of them was, of course, quite helpless in the matter. She did not know these optical whites were present in the detergents and, even if she did, she would not know what they were or that they were capable of completely altering the tones of pastel-shaded articles. These alterations in tone could not be avoided simply by washing whites and coloured separately. The optical bleaching agent did not differentiate between them but became fixed to each and every article being washed in the detergent in which it was incorporated.

It would be seen, therefore, that in relation to the washing of coloured articles and, in particular, the washing of those dyed a pastel shade, the presence of fluorescent compounds in detergents, far from being a welcome development was nothing less than a source of annoyance and complaint. The complaints were, of course, made to the textile manufacturer and not to the detergent maker, because it was always assumed that if a garment or household textile changed colour as a result of washing it was the dye at fault.

Having discussed the optical bleaching agents at some length, it will be opportune turning to some other sources of complaints which arose from the presence of chemical bleaching compounds in detergents, Mr. Ward said the first of these was the common one by which Royal Blue on wool developed a stain varying from a dull blue/green patch to a bright yellow/green area. This very bright shade could only be obtained by using a particular blue dye on the wool (colour index, Acid Blue 83). Unfortunately, this dye was very sensitive to peroxide compounds and so its use was limited. This change could take place at much lower temperatures than was commonly realised. At 110°F. a peroxide-containing detergent used in normal concentrations could bring about a marked change of shade. This temperature fell well inside the range known as "lukewarm" and consequently could not always be avoided by even a careful housewife. The bright green spots could, of course, be caused by the failure to dissolve the powder completely before immersing the garment thereby causing small pockets of high local concentration later on.

It was well known, of course, that these "per" salts had been used in soap powders for over forty years, but the unfortunate coincidence of sensitive dye and reactive chemical was a serious affair for the trade. It could be eliminated by using a combination of more stable dyes which, however, did not give the special shade which was so attractive. The solution was in the hands of the dye manufacturer.

They had also had numerous complaints of the formation of small pin-holes in cellulosic garments during washing with "oxygen" powders. It might be that these are caused by the catalytic action of traces of metals deposited on the fibres on the decomposition of the per-salts, causing intensely violent local action. It might be due, on the other hand, to the setting up of high local concentrations due to difficulty in completely dissolving the particles of the powder. Another source of complaint was the frequency with which mixtures of cotton dyes which were "fast to light" would fade on exposure to the sunshine of a summer day while hanging on a clothes-line. Some cheap dyes could be expected to fade under these conditions, but when mixtures of fast dyes did this some explanation must be sought. All they could say at the moment, continued Mr. Ward, was that one component of the dye mixture always appeared to be a particular cotton yellow (Colour index, Direct Yellow 28), and that the fading was

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stimulated by the presence of alkalies left in through incomplete rinsing after washing. Similar fabrics wetted with distilled water hardly faded at all; this again was a problem for the dyemaker.

While on the subject of light fading the speaker dealt with complaints arising from the rapid fading of most optical bleaching agents, especially on wool, when they were exposed to bright sunshine. The use of these "poor to light" products was deprecated by most manufacturers but the problem did present a challenge to the dyemakers. "We understand there is now available a fast to light optical bleaching agent for the man-made fibres and similar products for wool and cellulosic fibres would be very welcome," said Mr. Ward.

The next problem arose from the gradual deterioration of shade which many of the man-made fibres underwent when washed with modern detergents. A white nylon slip, for example, became a dirty grey after a few washes. To what degree the effect was due to the detergent or was an inherent fault of the fibre was a point which could be settled by co-operative research. A reference should also be made to the use of liquids containing chlorine compounds in domestic laundry. It was apparently quite a common practice to add a spoonful of one of these products to the detergent solution when washing white goods and this had been found to lead to quite a crop of different sorts of complaints. Such a procedure could lead to a serious weakening of the cloth, especially in the case of cotton and rayon. It could affect the shade and appearance by reacting with any fluorescent white or oxygen compound in the detergent. It could also lead to damage developing through the greatly increased activity of traces of chlorine retained by the fabric when subjected to the heat and steam from the ironing process.

Referring to a source of trouble which, while at present only very small, could easily become a major problem in the laundering of textiles, Mr. Ward pointed out that there were certain scouring powders now in common use actually marked as containing "bleach," which really meant they contained compounds which liberated chlorine when they become wet. These products were recommended for cleaning sinks, basins, washing machines, and rubber squeeze rollers, and were proving to be a source of accidental damage to textile materials. Undissolved powder coming into contact with wet fabrics could cause local bleaching of colours which were fast to all normal detergents. Although this type of damage was at present only caused by the careless use of scouring powders, or by accidental contamination of fabrics with these powders, it was understood that, in America, these organic chloro-compounds were now being incorporated in domestic washing powders, and that in this country their use was already being contemplated. If this development should take place on a large scale, one would expect the number of complaints of loss of colour, fading, local bleaching and bad wear, to increase considerably, and their introduction into domestic washing powders was viewed with great concern.

Much confusion existed in the public mind about these products and the use of some of them, even under normal conditions, could cause trouble and inconvenience in various directions. The fierce competition between the detergent manufacturers for this market had led to a spate of advertising which made the average housewife wonder how white was white and how bright was bright. It was well that the background of this competition should be explained and that the reason for the super-brightness of one product as compared with another, through the use of chemical or "optical" bleaching agents, should be widely understood. "We have no objection to the use of these materials as such," said Mr. Ward, "if it can be shown that the real dirt is removed and not masked by an artificial brightness, and provided that the effect is limited to white goods. We do complain when these synthetic additives spoil the colours of the textiles we produce and, while we do not go so far as to suggest that they should be done away with, we do put forward a plea that it should be made quite plain which detergents contain these products. A line of advertising which said that powder 'A' or flake 'B' contained no bleaching or fluorescing agent of any sort, but was simply designed to remove dirt and preserve all the qualities of the article without producing any artificial effect, would be welcomed."

View of the Manufacturer of Detergents

THERE was a well-known saying that "it would all come out in the wash," but this was capable of various interpretations. It might have reference to impending disaster or some pleasurable consequence. Applied literally to washing, it might refer to dirt removal, which was a good thing, or to some loss of textile quality, which could be decidedly bad," said Mr. F. P. Thompson, M.Sc.Tech., A.R.I.C.

It was true that the things that happened to textiles in use were often revealed at the wash stage, as this was a time of critical inspection, particularly on the ironing board. It was, therefore, not unreasonable for the textile manufacturer to have his attention drawn to criticisms of fabric performance more often than not at the wash stage, and eventually this could lead to a suspicion that wash products were not all they should be.

The textile and soap manufacturers and the laundries had excellent technical knowledge and facilities for doing a good job. Obviously each industry was endeavouring to give the public, their ultimate customers, the best product or service possible. The well-known domestic wash products were efficient and easy to use; the performance of textiles had never been so good as at present; and laundries turned out excellent work.

Instances did occur, however, of failure of fabric in some respect of performance—fortunately only rarely—when one interested party considered another was to blame. This was likely to be so and continue to be so, in this imperfect world. Fabrics, said Mr. Thompson, must be cleaned from dirt without damage to the cloth, a condition successfully attained. Washing without shrinkage and colour losses was not always possible, but the causes were well understood; inappropriate selection was sometimes the prime cause, particularly when merchandise covered such a wide price and quality range.

Modern washing powders were not the simple products of former times. They contained ingredients which at no little expense were included for specific purposes. Two special features were the ability to remove stains other than the usual dirt or grime—the table linen stains, for example, which resisted ordinary soap washing—and the production of high grade whiteness in cotton fabrics without resorting to chemical bleaches. Both these features were important advances in aiding the wash by reducing the labour and increasing the quality of the results.

There are a few instances, however, in which these modern and efficient products for the general wash had given rise to unwanted effects. A highly beneficial feature was the brilliant white wash produced in home washing without fear of damage by chemicals rotting the fabric. This was a great advance in quality of whiteness, so much so that most of the new articles bought had this extra white character already imparted by the manufacturers. There was one disadvantage; this brilliant whiteness could alter the shade of some colours. Often this was an improvement, and it was much used to increase the brilliance of prints. The effect was, however, to make creams paler and to make some shades—like pinks—slightly bluer. There was some controversy as to whether this was a serious matter. Admittedly there were circumstances when it showed up to its greatest degree—if, for example, a shirt was recollared, or if one of a pair of articles was altered in shade so that they no longer matched although these differences were evened out on subsequent washing. This effect was not in any way due to any fault of the dyed cotton but to the superimposing of the extra whitening effect so desirable in the main bulk of the family wash.

So many domestic textiles, said Mr. Thompson, carried this whitening influence that it was now impossible for the family loads of washing to be free of it; but these shade changes would not occur if the article were isolated and washed with a specially selected product not renowned for imparting whiteness to the family wash. Actually the soap makers had not found that the housewife was particularly troubled by this effect on colours; comment on this aspect is very rare. There were other textile faults, of course, that the housewife had to tolerate or learn partially to overcome. Obviously, for the best results it was necessary for the housewife to be selective in the wide choice she had.

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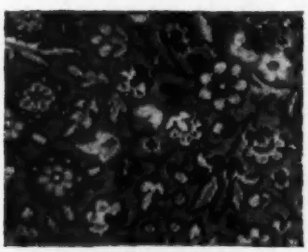

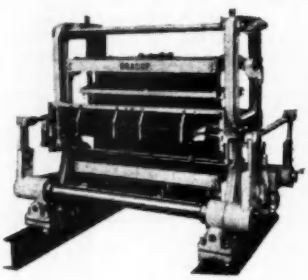

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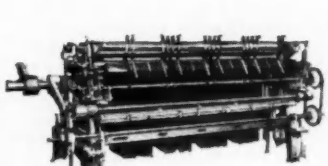

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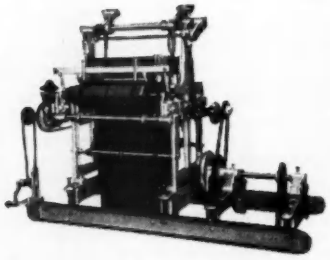

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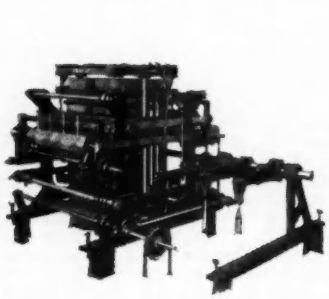

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Textile Institute Conference

The Dyestuffs Manufacturers' Point of View

DISCUSSING the problem from the point of view of the dyestuff manufacturers, Mr. G. S. J. White spoke of the past 100 years since Perkin, and suggested they might consider the great discoveries from the point of view of (*a*) chemical miracles and (*b*) target research. Chemical miracles appeared to occur infrequently and at approximately 30-year intervals. "Miracles" would include Perkin's original discovery, Griess's discovery of the diazo reaction and in recent years, the phthalocyanines. On the side of target research they could include that for the direct cotton dye, Congo Red as well as many others, up to the reactive dyes. Looking at the picture now, it was possible to summarise the needs of the day under three main headings: (*a*) ease of application; (*b*) colour fastness and especially for today, resistance to detergents; (*c*) colour gamut.

Mr. White paid a tribute to the pioneering spirit of British manufacturers in respect of labelling of products with a sound reputation. Reference was made to the "Felisol" label which was controlled by an international committee of dye users and makers, which had set up a technical body which tested and accepted dyes and dyeing as worthy of the "Felisol" label. In Britain, before the war, there was little use for this type of label but the British textile trade exporting to Europe would have to take more heed of the publicity and technical backing which had been brought to the point of recognition in the "Felisol" label. The good means of communication which existed from the dye maker downwards, might lead one to suppose that the ultimate consumer was in a satisfactory position but personal experience led one to believe that this was not so. Although so good in one direction, there was not great evidence that it was anything like so satisfactory in the return way.

The reactive dyes had been towards easier application in the category of high resistance to washing. They were in the early stages of their practical development and use so that it was not possible to be in as definite agreement about their dyeing and printing properties as it was with the older types of dye. But it seemed likely that to the dyer and printer, the application of colours of high fastness would call for increased processing and greater control than the techniques which produce satisfactory results with colours of lower fastness and this must make the result somewhat more costly. Thus greater resistance to washing was attained only at some increased cost in synthesis of the dye and in the dyeing method.

Summarising, Mr. White said that in general there was no technical reason why colours of textile goods should not be as permanent as the raw materials themselves. What then, was the problem of the dyemaker? It was, he said, to decide whether the results of speculative research in the field of dyes and colour were likely to be rewarded.

The research work referred to embraced three general catagories:—

(1) Work designed to improve the efficiency of manufacturing processes and to explore the possibility of alternative chemical roads. This clearly must continue until the manufacturer decides that his processes were so efficient that the return on more investigation was likely to be unrewarding.

(2) Research work was directed to improving the methods of application of the production already available.

(3) Research in the field of organic chemistry could be of speculative nature either embarked upon for some specific target as was the case of Bottiger or of the less orientated and integrated dyer research which might lead at very infrequent intervals of time to a new organic chromophore.

For the purpose of this argument it could be assumed that the world expenditure on dyes was of the order of £300,000,000. If they took 5% as an approximate figure for the percentage of turnover devoted to research, it was evident that £15,000,000 in total might be spent each year on improving manufacturing processes, improving methods of application and on looking for new dyes and pigments. If a quarter of the money spent was devoted to the speculative object then this was equivalent to £4,000,000 which in turn meant that about 1,000 chemists with an equal number of assistants were seeking new dyes and new chromophores. Could the unsatisfied needs of the textile industry sustain such an army of speculative dye chemists? To this question the foregoing analysis made a qualified "no" the inevitable answer. Only a diminishing number of small and very specialised targets remained to be attacked.

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A NEW inexpensive, adjustable plastic closure for polythene and other film bags, the "Vari-clip," is marketed by Sealdraught Ltd., Chandos House, Buckingham Gate, London, W.1. Available in four attractive colours, it is 2¼ ins. long, has four square holes at one end and a toggle at the other, making it adjustable to any one of four diameters. The smallest diameter the clip will make is approximately ¼ in. and the largest approximately ⅝ in. The bag to be closed is simply laid across the clip and the toggle twisted through the appropriate hole. The closure made in this way is excellent for keeping out dust, damp and odours. It can be used for dry or non-perishable goods where a completely airtight seal is unnecessary. Another advantage of this plastic closure lies in its re-usability. It is durable and can be used over and over again. It is ideal, for instance, in packing articles which are often removed from bags for examination by customers. The article can be replaced and the bag re-sealed without damage to either bag or clip.

L.L.U. TRANSLATIONS BULLETIN. The Department of Scientific and Industrial Research's Lending Library Unit has introduced a new publication, "The L.L.U. Translations Bulletin," which aims to provide British scientists and engineers with up-to-date information on the availability of Russian translations. Published monthly, price 4s., the first issue contains lists of books, journals and other scientific papers which are now available or which are being translated and will become available in the near future. One section deals with cover-to-cover translations—a scheme for providing a complete Russian technical journal in the English language—and another gives details of the work being carried out by the National Science Foundation in the U.S., with whom the L.L.U. collaborates in this translation scheme. Many translations from America are held in London on microfilm and photo-copies may be borrowed.

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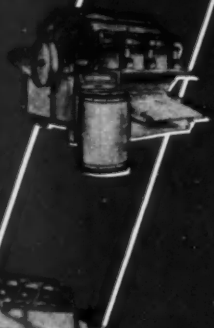

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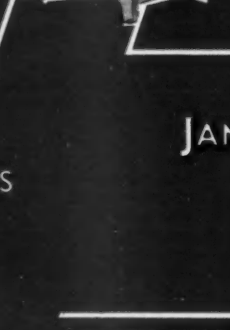

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The firm of Cia. Importadora de Material Industrial y Cientifico, Apartado 807, Ciudad Trujillo, would like to represent a firm manufacturing all kinds of expendable material used by shipyards, such as lamps, caulking cotton, caulking yarn, marine cables (preferably U.S. Navy specifications) and manila ropes as per B.I.S.S. specification. Manufacturers interested should write direct, also notify the Commercial Department, British Embassy, No. 54 Avenida Independencia, Ciudad Trujillo.

Western Germany:
Furnishing Fabrics

The Union Syndikat Handelsgesellschaft mbH of Kaiserstr. 65 IV Frankfurt am Main, are interested in receiving offers of furnishing and upholstery fabrics from U.K. manufacturers. Established in 1920, they are importers, exporters and wholesalers of textiles of all kinds. Manufacturers interested should write direct, giving c.i.f. Hamburg prices in D.M. and particulars of delivery dates, also notify the British Consulate-General, Commercial Section, 47 Zeppelin Allee, Frankfurt am Main.

Western Germany
Woollen Slivers

The firm of Ewald Rueggeberg, Remscheid-Lennep, Bahnhofstrasse 14, want to contact U.K. manufacturers of woollen slivers with a view to acting as agents. Established in 1919, they supply mainly to tailors and retailers. Manufacturers interested should write direct, also notify the British Consulate-General, Cecilienalle 16, Duesseldorf.

Western Germany
Woollen and Worsted Piece Goods

Swoboda and Co., Trutzhain, Krs. Ziegenhain/Hessen, want to contact U.K. manufacturers of woollen and worsted piece goods suitable for the production of men's, women's, children's and sports outerwear. The company have about 32 employees and claim their organisation is capable of covering the whole of Germany. Manufacturers interested should write direct quoting c.i.f. Hamburg prices in Deutschmarks, also notify the British Consulate-General, 47 Zeppelin Allee, Frankfurt.

Western Germany
Harris Tweed

Mr. K. Hilb, Mendelssohnstr. 47/II, Frankfurt am Main, would like to contact a manufacturer of Harris tweed with a view to representating them in Germany. The cloths he has in mind are those sold under the "Orb" sign. Manufacturers interested should write direct, also notify the British Consulate-General, Zeppelinallee 47, Frankfurt.

Western Germany:
Worsted Piece Goods

The firm of Adolf Weitz o.H.G. or Cretzschmarstrasse 18, Frankfurt/Main, want to contact a U.K. manufacturer of medium quality worsted piece goods. Founded in 1938, they represent well-known German and foreign cloth manufacturers, including a U.K. manufacturer of high grade woollen piece goods, and cover the districts of Hesse, Baden-Wuerttemberg, Pfalz and Lower Frankonia. Manufacturers interested should write direct, also notify the British Consulate-General, 47 Zeppelin Allee, Frankfurt/Main.

South Africa:
Cotton and Woollen Piece Goods

The firm of Jack George, 201 Sacta House, 277 Bree Street, Johannesburg, wish to obtain U.K. agencies for cotton and woollen piece goods. Established in 1948, act as manufacturers' agents and at present represent three U.K. firms for lace-edged goods, gloves and boys' outerwear. Manufacturers interested should write direct also notify the U.K. Trade Commissioner, P.O. Box 10101, 52 Pritchard Street, Johannesburg.

Canada:
Haberdashery and Trimmings

Approved Accessories Inc., 5170 Henri Julien Street, Montreal, is interested in receiving samples and quotations from U.K. manufacturers of buttons, buckles, fasteners and allied products.

A copy of the Canadian firm's catalogue illustrating the type of merchandise in which they are interested, is available for inspection in Room 620 at this Branch. Additional copies are available for loan in order of receipt of applications.

Approved Accessories Inc., who were established in 1955 as wholesalers and jobbers of hard haberdashery, the claim to be able to cover all Canada through salesmen in offices in Montreal, Toronto and Winnipeg. Manufacturers interested should write direct, also notify the U.K. Trade Commissioner, 1111 Beaver Hall Hill, Montreal, Canada, that they have done so.

South Africa:
Trouser Waistbands

Maritime Agencies (Pty.) Ltd., P.O. Box 8090, Johannesburg, would like to represent a U.K. manufacturer of rubberised trouser waistbands. Established in 1946 as manufacturers' representatives, they hold a number of U.K., American, Belgian and Dutch agencies for hosiery and knitted outerwear, shirting poplins and linings, all types of waistbands, suitings, etc. They employ eight travellers and cover the whole of the Union of South Africa. Manufacturers interested should write direct, also notify the U.K. Trade Commissioner, P.O. Box 1010, 52 Pritchard Street, Johannesburg.

Kuwait:
Various Goods

The British Political Agency in Kuwait would like to receive trade literature from small manufacturers interested in Middle East Trade, so that they may circulate it to Kuwaiti importers. Catalogues describing children's wear, men's hosiery, curtaining material, knitting wools, needles, etc. Interested manufacturers should send their literature direct to the British Political Agency, Commercial Office, P.O. Box 300, Kuwait.

Western Germany:
Cotton Velvet

The firm of Ludwig Greinsberger, Bayern/obb, Uffing am Staffelsee, Seeweg 138½, would welcome quotations for rose-coloured cotton velvet. Established in 1925, they are manufacturers of powder puffs and related articles, and firms interested should write direct, also notify the British Consulate-General, Munich 13, Akademiestrasse 7.

Singapore:
Cotton, etc. Piece-Goods

Borneo-Malaya Representatives Ltd., Crosby House, Robinson Road, Singapore 1, would like to obtain agencies for U.K. manufacturers of plain printed and dyed cotton hair-cords, voiles, organdie, shirtings, curtain laces, also piece-goods of mohair/wool, "Terylene"/wool, worsted pick and pick, tweeds and blazer material. They are prepared to work on a commission of 5% and would like interested manufacturers to quote c.i.f. prices. The organisation have offices in Singapore, Federation of Malaya, Siam, Sarawak, Brunei State and the Colony of North Borneo. Manufacturers interested should write direct, also notify the U.K. Trade Commissioner, P.O. Box 620, Fullerton Building, Singapore.

Trinidad:
Cotton Piece-Goods

Agostini Bros. Ltd., Cor. Queen and Chacon Sts., Port of Spain, are interested in obtaining the representation of a Lancashire manufacturer of cotton piece-goods. They are an old-established firm of commission agents employing a number of salesmen. Manufacturers interested should write direct, also notify the U.K. Trade Commissioner, Colonial Building, South Quay (P.O. Box 225), Port of Spain, Trinidad.

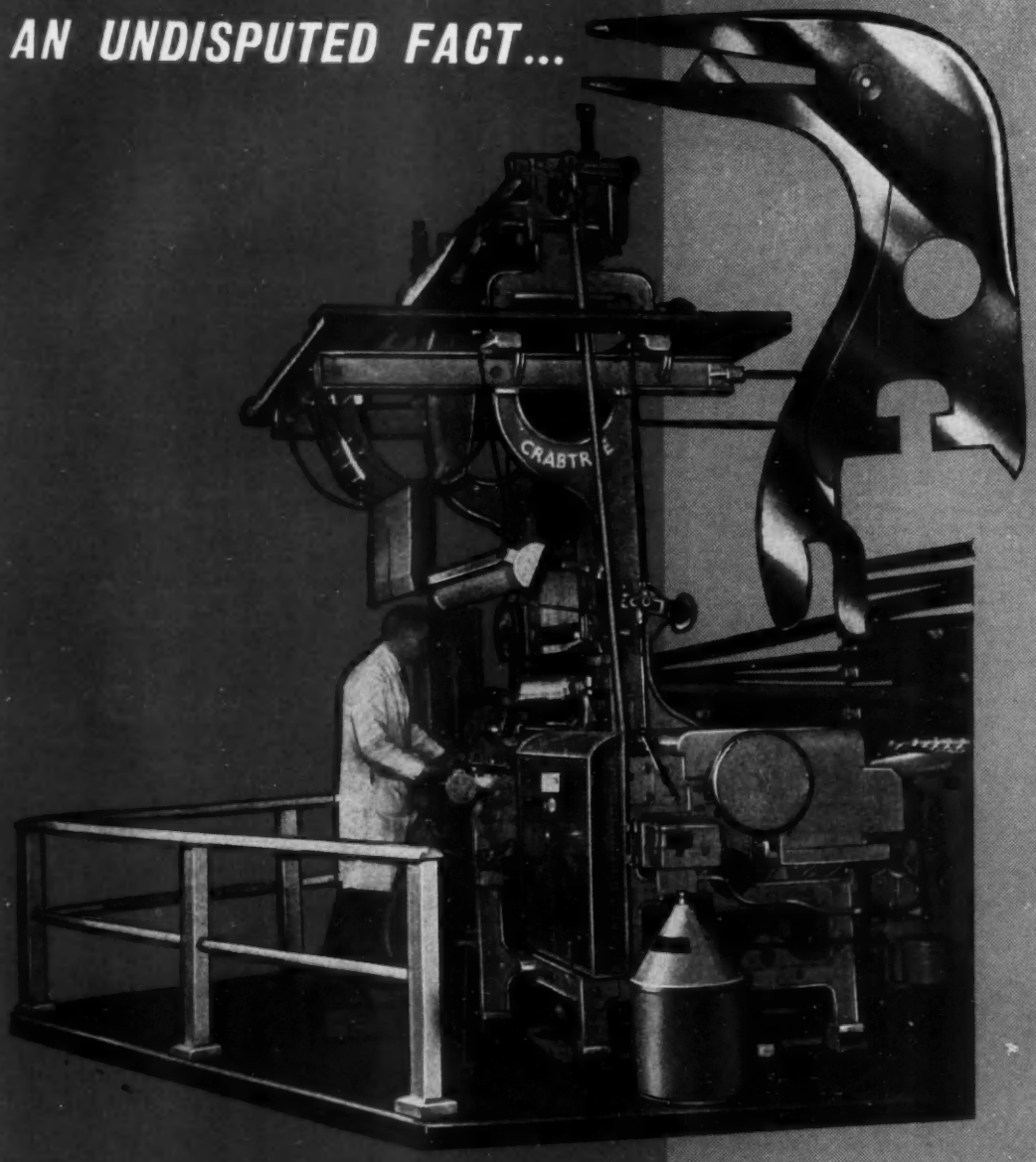
U.S.A.:
Blankets, etc.

Loma Supply Corporation, 8001 Othello, San Diego 11, California, want to contact U.K. manufacturers of blankets, robes and men's wool hosiery. They are the buying agency for "Fed-Mart," a chain of general merchandise stores in California, Arizona and Texas. Manufacturers interested should write direct with quotations showing both f.o.b. and c.i.f. prices in U.S. currency, also copy correspondence to the British Consulate-General, Commercial Section, 448 South Hill Street, Los Angeles 13, California.

Sweden:
Combed Cotton Yarns

The firm of Petrus Skoglund, Sandgärdsgatan 10, Borås, would like to obtain a U.K. agency for fine combed cotton yarns. They would work on a commission basis, covering west and south Sweden, plus the town of Norrköping. The firm has been in business since 1922 and represents two U.K. wool top manufacturers; they employ three salesmen. Spinners interested should write direct, also notify the Commercial Secretariat, British Embassy, Strandvagen 82, Stockholm.

IT'S AN UNDISPUTED FACT...



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Textile Trade and Prospects

Cotton Yarn and Cloth Business Still Shaky

Trading in yarn and cloth is still far from normal. Business remains very scrappy with yarn quotations showing considerable variation for similar counts and qualities. Machinery activity remains low and the closing of mills, the Hongkong agreement, and ending of the yarn agreement have, as yet, had little effect on productive inquiry. The entire market still lacks confidence and some salesmen are obviously quite at sea in these new surroundings. Trading conducted in sheltered harbours for so many years has given rise to a situation where business "edge" has been completely dulled. The nervous tension created by the shake-up is reflected in the actions of both sellers and buyers and this atmosphere has again given impetus to more complaints in efforts to get lower prices or as excuses for cancellations. Spinners report considerable inquiry but insufficient firm bookings and quotations have covered practically every count and quality. The bulk of available business has been in standard weaving qualities in medium counts on ring beams, cone, cheese and cop form. Coarse ring yarns have been fairly well supported and the interest in condenser counts has improved slightly. Sales of Egyptian-type yarns—especially mule—remain very disappointing. A little better tone has been noticed in one or two hosiery qualities, blended types and specialities but total turnover is still below the depleted machine capacity.

Uncertainties in the raw material and yarn situation reflects itself in cloth buying. Although there are indications that stocks in merchants' and wholesalers' hands are now lower than for some time there is little indication yet of any surge of fresh business. Orders put through have in no single instance been large and bookings finalised are in most cases for early delivery. The next couple of months should see some progress as many of the tangible factors affecting the future become clearer. A wide variety of apparel cloths have been inquired after and quoted for but there is considerable reluctance among traders to commit themselves to orders or business too far ahead. New designs in neat dobby and jacquard patterns, also a limitless range of machine and screen printed styles are available at prices which do not leave the manufacturer much margin. Shirtings in cotton, and blended cloths still do not attract much new business but most firms are thankful to be in the position of managing to hold their own in truly difficult circumstances. The position in household textiles is, perhaps, a trifle better with the off-take in terry cloths slightly higher. Medium and better qualities of hand towels are finding a little more support but the low-priced cloths are extremely difficult to sell. Some novel and bright machine printed terry cloth attracts buyers for the making-up trade for holiday, etc., garments. A type of terry bedspread in which the effect yarns are extremely coarse—probably roving—seems to be selling steadily although the output appears limited. Business in sheetings, quilts, cotton blankets and table cloths is still very poor. Furnishing fabrics are moving a little better and the orders fixed are something like equally shared between woven cloths and printed types. Traditional and contemporary patterns have both been in request on a better scale. The range today is better than at any time in the history of textiles and the infinite number of patterns, colours and blends has never before been equalled. No country in the world has a wider range of cloths to suit particular circumstances and schemes for internal decoration. True as this is, sales of British made cloths in export markets are pathetically low. Apart from small orders from one or two Dominion and Continental markets the sales could hardly be worse in both yarns and cloths. Industrial cloths—home and overseas—have had a little more active support in which cotton, rayon, nylon and "Terylene" have benefited.

Wool Textile Exports

The latest issue of "Wool Textile Bulletin" states that 1958 was a year of falling prices and fairly general decline in exports of wool textiles. The fall in the value of our exports was considerably greater than the fall in actual value of goods shipped and it seems probable that the British wool textile industry weathered last year's recession a great deal better than other major exporting countries. Considered separately, exports of all types of yarn were in volume 15% lower than in 1957 and shipments of cloth were nearly 13% down. On the other hand, top exports set another world record for the third year in succession, reaching a level over 6% above the old record set in 1957. The overall result of these fluctuations was a drop of 5% in the total volume of goods exported which—combined with a 10% drop in prices—led to a fall of around 15% in the value of our export earnings.

Chief factor in the increase in top exports was the expansion of trade with China—almost double that in 1957. These exports, incidentally, accounted for nearly 25% of the U.K.'s total exports to China. The Egyptian market recovered strongly during 1958 and shipments to Italy doubled. Trade with Turkey also showed a considerable improvement and some ground was gained in Eire, Hungary and Poland. In contrast, exports were generally below 1957 levels with substantial falls in shipments to Canada, Greece, Scandinavia, Europe and Hongkong.

Exports of yarn to West Germany, our biggest market, fell for the first time since 1951. Our next three markets—New Zealand, Ireland and Canada—each took slightly more than in 1957, but deliveries to all other major markets fell. The largest falls in volume occurred in exports to South Africa and Hongkong with other sizeable declines evident in the Dutch and Scandinavian markets. There were signs, however, of some easing of the situation in the latter areas during the last quarter of the year.

Woollen and worsted cloth exports were badly affected by the decline in trade with the north American markets, the overall loss amounting to almost 7,000,000 sq. yds. Trade, however, did improve in some markets, notably West Germany and Venezuela and shipments to South Africa, Ireland and the Middle East were fairly well maintained at 1957 levels. The general trend, however, was downwards, the heaviest losses being in Hongkong and Cyprus and large percentage drops occurring in exports to Peru, India and Brazil. The figures for 1950 with the 1957 figures in brackets are: tops 83·334 mill. lbs. (88·846); yarns 29·922 mill. lbs. (25·300); tissues 108,983 mill. sq. yds. (95·226).

Linen Trade Review

At the present rate of contraction in output capacity in all sections of the industry consequent on firms going into liquidation the problem of redundancy should be solved in the not distant future. It is possible also that the rate of decline in demand for linen manufactures and man-made fibre yarns and fabrics produced on linen machinery may level off, or even show an upturn, with some successful effort to stimulate consumer demand.

Judging from the lack of interest shown by the trade in the recent textile show at Earls Court, where the products of the industry constituted an insignificant fraction of the total on display, there is considerable scope for development. Too many manufacturers and sales executives in the industry still cherish the fallacy that linen will sell "on its merits" at almost any price, ignoring the fact that products of the man-made fibre industries can now be tailored to almost any end requirement to give equal—and in many instances—vastly superior service to the natural fibre products, at highly competitive prices.

That a demand still exists for linen in world markets is evidenced from the balance sheets of those firms that have taken the trouble to study consumer interests, which are dominated by price and novelty, with emphasis on the former. Efforts to make linen more competitive on a price basis have not been entirely successful, despite the substantial outlay on re-equipment and re-deployment. While the main hope in this direction centres on an adequate supply of raw material which would be obtainable at a price comparable with that of competitors after due allowance for losses incurred in processing, the lack of support accorded to the domestic fibre flax growing industry in post-war years has now made flax spinners entirely dependent on overseas sources for their requirements with the additional expense

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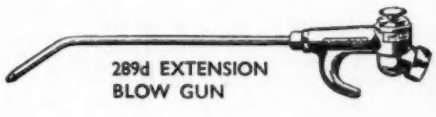
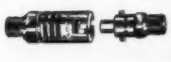
Powerful, safe and clean, compressed air is ideal for dusting down machinery, hence the increasing use being made in the textile industry of B.E.N. Air Compressors and Blow Guns. Full use of Instantair Couplings in the air line ensures complete flexibility and enables Air Blow Guns to be immediately available for every frame or loom. Air Compressors—portable and stationary—from 2 c.f.m. upwards.



289d EXTENSION BLOW GUN

289 BLOW GUN



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and grave risk of exploitation that it presents.

There has been a progressive decline in quality of fibre produced from crops grown in France and Belgium in recent years. Growers are concentrating more on white flower strains which are notable for yield rather than for the quality of fibre produced. Consequently spinners are finding considerable difficulcy in obtaining a sufficient quantity of high grade material suitable for fine cambric and prime warp yarns. The present limited demand for these is defined mainly by the price which, in turn, is determined largely by cost of raw material. An adequate supply of suitable grades at an economic price would go far towards checking the downward trend of demand for linen in world markets.

With the sowing season at hand and a negligible demand for seed the acreage of home grown flax is not expected to exceed 1,000 acres, so that the industry must continue to depend on overseas sources for its raw material needs. High labour costs and spinners' resistance to any advance in price levels have eliminated profit margins on French and Belgian supplies. This, together with the recent decision by the Belgian Government to stop payment of the 2,000 francs per hectare premium on this year's sowings will undoubtedly have an adverse effect on the 1959 crop acreage there.

The yarn market is just sufficiently animated to prevent accumulation of stocks in spinning mills, many of which are operating substantially below productive capacity. Mill executives are concerned with the problem whether it is more economic to install high speed ring spinning frames which they may not be able to maintain in full production with double shift working, or to carry on with old flyer frames which are giving complete satisfaction within their output limitations. There is no substantial measure of agreement on the correct answer.

Despite the greater adaptability of machinery in the weaving section for processing man-made and other fibres, factories have felt keenly the pressure of competition, as evidenced by the number of closures in recent months. In this section also re-equipment has failed to provide the anticipated safeguard, some executives claiming that the modern set-up is too inflexible for the ever changing demands of the consumer market today.

Jute Fibre, Yarns and Cloth

No change has occurred in raw jute markets in Pakistan during the past month. Offers of medium and lower grades were freely made but the higher qualities are still scarce. So far as the U.K. is concerned very little purchasing of raw material has taken place, considerable quantities being secured earlier in the season. Dundee spinners have now obtained the bulk of raw jute required from the present crop and not much more buying will take place until new crop fibre becomes available. The government of East Pakistan has decided that a total area of land in which jute as well as mesta may be grown in 1959 will be the total basic area of land recorded in 1940 and revised in 1950. It is understood the decision had been taken in accordance with the provisions laid down by the Jute Advisory Board. So far as can be ascertained this decision will mean that a slightly larger area will be put under jute cultivation during season 1959-60 as compared with last year.

In Dundee, raw jute markets have been quiet and lifeless during the past month although the position has been quite steady in Pakistan. Spinners in Dundee and district are well supplied with raw material and at the same time a considerable quantity of raw jute is available on spot. The bulk of this material is of low or medium quality and spinners have sufficient of this type of fibre in stock. If shippers were in a position to make offers of some of the higher grades there is no doubt that a renewed interest would be shown.

Mill Firsts are not freely offered with prices ranging from £110 and the general price now quoted for Mill Lightnings is £90. Mill Hearts are freely available at £78 and grade Hearts at £64, c.i.f. U.K., March./April shipment. There are sellers of secured parcels willing to accept less than the above rates for Mill and grade Hearts but the quantities available are small. Quite a few shippers are still making combined offers of high and low grades in an effort to dispose of poorer qualities but this is not attracting any buying interest.

Prices of dark jute are also unchanged with grade Tossa-2/3 offered at £110 to £112 but grade Tossa-4 is freely available at £94 and in some instances less has been accepted for the latter. Continental Tossa-2/3 is offered at £86 and Continental Tossa-4 at £73. Crack Daisee-2/3 remains at £93 and grade Daisee-2/3 at £86, c.i.f. U.K., Mar./April.

No interest is being shown in Indian jute. It was announced in January that India had decided to make available for export a certain quantity of raw jute and spinners in various countries including the U.K. made purchases. The quantities bought were small and generally confined to sample parcels as the quality of Indian jute was unknown to overseas consumers. When these sales took place it was thought that Indian jute would not have to bear export duty and business took place on that assumption. However, there appears to be an order which has never been rescinded stating that the export duty on Indian jute is RS. 15 per bale. Due to this question of export duty, no shipments have so far been made.

The Calcutta goods market became easier towards the end of February but since then the position has remained fairly steady although irregular. It was announced during February that the Indian Jute Mills Association had decided to abandon minimum price agreement for jute goods and at the same time it was announced that 1½% of the looms would be sealed to reduce output and if this were not sufficient a further 1% would be sealed at a later date.

Indian mills have been working 48 hours per week with 12½% of looms sealed since September 1956. Stocks of hessians held by the mills have fallen steadily since the middle of last year and are now at a very low level. However, the same cannot be said about sackings and fairly large quantities are held. The total strength of looms in India at the beginning of last year was 68,953. Of this number 65,094 looms belonged to members of the Indian Jute Mills Association. The break-up of the latter figure gives 42,081 hessian looms 23,031 sacking looms and 3,218 other looms.

Prices of Calcutta hessians are now at 57s. 9d. for 10 ozs. 40 ins., and at 44s. 3d. for 7½ ozs. with 11 ozs. 45 ins. at 63s. 9d. per 100 yards f.o.b. Calcutta for March shipment, and at 57s. 6d., 44s. and 63s. 6d. respectively April. Sackings were quiet with B twills quoted at 134s. 6d. March and at 135s. April. Demand for yarns and cloth has become quieter in Dundee during the past month and less buying has taken place. Most producers are still fairly comfortably placed with orders in hand for delivery over the next two months. The floor covering industries have taken regular deliveries of late but this end of the trade has also become quieter.

Man-Made Yarns and Fabrics

The outlook during the past few weeks has been more optimistic: a slight improvement in the Lancashire situation will probably be maintained. Use of new fibres in Lancashire continues to expand slowly and more acrylic fibres are also being spun on the Lancashire system. Yarns of cotton/nylon are in good demand but all cotton yarns continue to hold their major proportion in the poor market conditions. In furnishings rayon/cotton blends are in good request and a new development is acetate rayon for wadding. This is being used in an increasing number of applications such as car upholstery, car insulation, window insulation and bed-heads. For bed-heads the wadding is covered by an attractive plastic fabric which is high-frequency welded.

In the Yorkshire trade the demand for blended yarns and fabrics continues at a steady rate and some interesting novelty developments with "Terylene"/wool and all-"Acrilan" cloths are reported. For the Midlands trade, hosiery yarns of all nylon or all "Terylene" are on the increase.

Business in Leek and Macclesfield sections is slow but advance booking is rather better. Roller and screen printer firms would welcome more inquiry and manufacturers are also rather apprehensive in view of the continued lack of interest. Dyers on the other hand—particularly in ladies' hose—are fairly busy and activity in some lines of knitted outerwear has been somewhat better, but forward bookings over the whole industry are rather disappointing. This does not necessarily imply that trade will worsen but the fact that bookings are later denotes that an air of caution persists. Another factor which may be delaying orders is the approach of the Budget and the question of purchase tax.

Smallwares tempo of activity is similar to that of last year and last month. In this section there is also forwarding ordering caution.

Regarding threads, news from this section of the Leek trade is that activity is down compared with last year. There remains plenty of scope for further business.

Although competition in the underwear section of the industry is keen, the demand for brighter and more varied colours increases. There is also an increasing demand for waist skirts and interest in brushed nylon nightwear is sustained. Good sales' forces backed by smart advertising certainly maintains the flow of orders and stimulates new ideas.

Midlands traders are feeling the effects of imports from Hongkong, Italy and other continental countries. Apart from this the demand for good quality knitwear, especially double jersey knit fabric, remains reasonably good. In half-hose, "Terylene" and nylon both sell well—in fact the bulk of the demand is for these.

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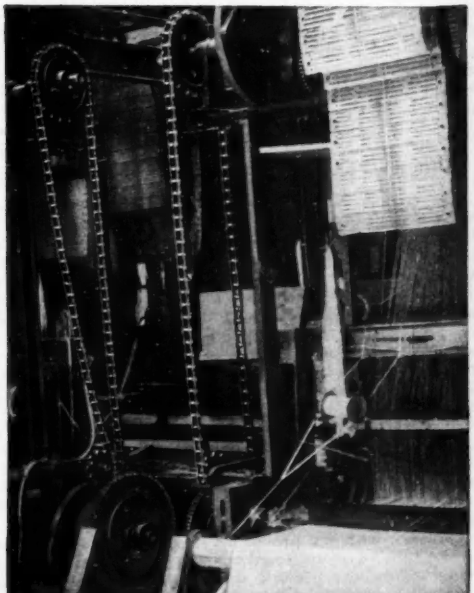
1 Heald lift sets

Standardised chain and guide pinion sets for directly replacing existing lift tackle — eliminate shut-downs for adjustment — no hold-ups due to dropped heald shafts — no variation in length, regardless of humidity or temperature.



2 MARK 5 Jacquard drives

Stock roller chain drives for single or double lift Jacquards —the corrosion resistant roller chain transmission that eliminates mal-timing of Jacquard, absorbs minimum power, and ensures smooth operation, fewer harness breakages and a better weave.

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Notes and News

Galvanised Slotted Angle

Galvanised Dexion with a 3/1,000th inch coating, developed specially for outdoor structures or for use in atmospheres where normal metal is subject to corrosion, will be available shortly in all standard Dexion sizes except 112 and can be seen at the Dexion exhibition at Stourbridge Park, Wembley, May 26 to June 4. The company's new multi-purpose grid, which can be used for the quick and easy assembly of anything from work platforms and car ramps to mobile platforms and trolleys, will also be on view.

* * *

Pneumatic Equipment

Martonair Ltd., Richmond, Surrey, have opened a Manchester office at 66 Mosley Street, Manchester 2 (CEN 0032). It is managed by Mr. E. Donlon, and will carry stocks of cylinders, control valves and accessories.

* * *

Viscose Price Reduction

The price for Courtaulds' standard bleached viscose rayon staple and tow has been reduced from 24d. to 22·75d. per lb., and for standard bleached crimped staple from 27d. to 25d. per lb.

* * *

Research in Textiles

Three Cantor lectures are to be given at the Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2, on April 20 and 27, and May 4. Professor Speakman will speak on "Research in Wool"; Professor Vincent on "Research in Cotton"; and Mr. J. R. Whinfield on "Research in Man-made Fibres."

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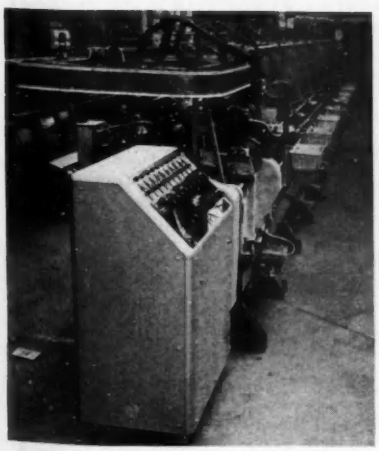

The new control console made by S. A. Monk (Sutton-in-Ashfield) Ltd., is claimed to reduce setting time of full-fashioned knitting machines. Considered to be more efficient and convenient than the panel control the console, which controls the shape of the garment during knitting and fashioning, is not permanently linked to the machine.

Bradford President Forecasts Brighter Future

"The wool textile trade has turned the corner, and faces a brighter future," declared Mr. J. L. Hanson, a leading worsted manufacturer, in his presidential address to the annual meeting of the Bradford Chamber of Commerce. Over the past year, he said, the industry had endured an "ordeal by bank rate" and had seen commodity prices fall alarmingly. The effect on many businesses had been severe but inflation had been checked, confidence in the pound restored, and those who had weathered the storm better for the experience. The inflationary days had been halted and a keener and more realistic atmosphere was apparent. "Today," said Mr. Hanson, "we are probably witnessing greater efforts than ever before. The increased efficiency and production resulting from this new approach—greater co-operation between management, administrative staff and employees in the wool textile industry—add to my confidence in the future. I have great faith in the wool textile trade and in the ability of the industry of this country generally to produce goods of a quality, standard and price which can meet competition from any part of the world."

* * *

Wool Imports into Britain

Imports of raw wool into the U.K. in the first two months this year totalled 142·2 million lbs. (actual weight), compared with 110·9 million lbs. in the corresponding period last year, an increase of 28%. The figures appear in B.o.T. Trade and Navigation Accounts. Imports during January were the highest of any month for two years, and although February imports were not up to the same level—possibly owing to the year-end lull in Commonwealth marketing programmes—they were 16% higher than in February 1958. Over the two months, imports of 67 million lbs. from Australia are about 30% higher than in the corresponding period of last year, imports of 12 million lbs. from South Africa are approximately 50% greater, and imports of 32·7 million lbs. from New Zealand are slightly lower than a year earlier. Substantial increases are shown in wool imports from Argentina and Uruguay, following a relaxation of recent currency and other restrictions.

* * *

Production of Man-made Fibres

Production of man-made fibres in January was 13% more than a year earlier; the increase, mainly of staple fibre, was about the same as in December. Output was depressed during most of 1958 but there was a marked recovery in the closing months of the year.

(Million lb. "delivered weight" basis)

	C.F. Yarn (Singles)	Staple
1958 Jan. ..	18.9	21.9
„ Nov. ..	15.5	22.1
„ Dec. ..	16.8	23.4
1959 Jan. ..	19.6	26.5

Change of Address

The London office of Rocol Ltd., manufacturers of a wide range of molybdenum disulphide and other specialised lubricants known and sold throughout the world, is now at General Buildings, Aldwych, London, W.C.2 (Tel. HOLborn 1985).

* * *

New Weaving Mill

MOST people in Lancashire will find it difficult to understand why the Government should have given financial aid for the setting up of a new textile mill in Great Yarmouth in Norfolk when many Lancashire mills are empty and looms are idle. But this has actually happened and the reason given by the man behind the new project, 40-year-old Hungarian textile manufacturer and designer, Mr. F. Ungar, is that he could not find a Lancashire mill willing to go in with him on a fifty-fifty basis.

Mr. Ungar left Hungary eleven years ago and has worked in Lancashire as a technical director and designer for West Cumberland Silk Mills and Fras. Hinde and Sons Ltd., Norwich. He will begin production at Great Yarmouth in April in a converted modern-type school building, with 12 Ruti jacquard looms, and preparation machinery. He will train his labour, and within three years plans to have expanded to 100 looms and employ about 200 operatives.

Mr. F. Ungar (left) and Mr. G. E. Macpherson examine a jacquard which arrived by air for Mr. Ungar's new mill

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• Withstand high starting torques, sudden shocks and pulsating loads.
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YOU CAN'T RISK costly shutdowns on full-scale production jobs – that's why Goodyear belts are the wisest choice for Multi-Vee drives. They can be fitted and forgotten – there's no better testimony to their trouble-free operation! There's a range of these 'job-designed' Goodyear V-Belts to give longer service and more efficient transmission on every type of drive.

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Cotton Board Appointment

Mr. F. Rostron, M.B.E., M.I.E.E., M.I.Ex. (director, Ferranti Ltd.) has been appointed independent member of the Cotton Board. He succeeds Mr. W. D'Arcy Madden, C.B.E., J.P.

* * *

British Wool Sales Programme

The Committee of London Wool Brokers announce the following programme of sale dates for English and Welsh wool during the 1959 - 60 season:—

July .. Leicester, 22nd.
Sep. .. Bradford, 9th; Exeter, 15th; London, 17th; Leicester, 30th.
Oct. .. Bradford, 21st.
Nov... Leicester, 18th.
Dec... Bradford, 2nd; Exeter, 8th; London, 10th.

1960 —

Jan. .. Bradford, 13th.
Feb... Leicester, 3rd; Exeter, 16th; London, 18th.
Mar... Bradford, 2nd; Leicester, 30th.
May .. Bradford, 4th; Exeter, 17th; London, 19th.
June .. Bradford, 22nd.

* * *

U.K. Wool Stocks

Bigger imports of wool into the U.K. in the past few months are reflected in the fact that at January 31, the total stock of wool in the country was estimated by the Wool Industry Bureau of Statistics at 257·5 million lbs. (clean weight), an increase of 23·1 million lbs. compared with the end of January last year. Stocks of wool tops in the U.K. at January last are estimated by the Bureau at 56·8 million lbs., which were 8·1 million lbs. more than a year ago. Stocks of domestic wool in the hands of the British Wool Marketing Board at January 31, were estimated to have a clean equivalent of 22·8 million lbs.

* * *

U.S.S.R. Contracts for Platts

Platt Bros. (Sales) Ltd., a subsidiary of Stone-Platt Industries Ltd., have received direct and indirect orders amounting to £1,000,000 for tyre cord machinery for the U.S.S.R. The orders include a sub-contract from Chatillon Soc. An. It. per le Fibre Tessile Artificiali S.p.A., the Italian rayon producers of Milan, as part of a complete high tenacity tyre cord producing plant they are supplying to the U.S.S.R., together with an order placed direct with Platt Bros. (Sales) Ltd. by Techmash-import, U.S.S.R., for similar machines. The bulk of the machinery will be manufactured at the company's Accrington works.

* * *

More Firms Using Unifil

A recent announcement from Universal Winding Co., Providence 1, R.I., U.S.A., states that the following have ordered Unifil loom winders during the past few months: Bemis Brothers Bag Co., Bruck Mills Ltd. (Canada), Cadillac Textiles Inc., Canadian Celanese Ltd., Exposition Cotton Mills Co., Glen Raven Silk Mills, Jaunty Fabrics Corp., Kalco Weaving Corp., Marion Manufacturing Co., Paxon Fabrics Corp., Riverside Mills (New Bedford, Mass.), William Skinner and Sons, and Strasburg Textile Mills. In addition, they have received orders from 13 other companies whose names cannot yet be disclosed.

Morgan Sintered Metal Department

Recent impressive increases in the demand for the sintered metal products of Morgan Crucible Co. Ltd., have led to a move to larger premises. The sales office has been moved to Wandsworth Works, Point Pleasant, Wandsworth, London S.W. 18, and a new factory and laboratory established there for the production and development of Sinterlink. This combines plant and facilities previously situated at Battersea, and Norton, Worcester. Phase I of the move has now been completed and has been carried out without interruption of output (in fact output has been stepped up). When the next and final stage is completed—by the middle of the year—production capacity will be available on a much increased scale.

* * *

New Finishing Agent

I.C.I. Dyestuffs Division have introduced Velan NW to their range of textile finishing agents. It is an improved type of durable water-repellent finishing agent, also designed for application in resin finishing. In degree of water repellency and durability Velan NW is comparable with Velan PF, but unlike this, it needs no final washing-off treatment to develop full effectiveness. Pointing out that it is of great interest as an auxiliary for resin finishing I.C.I. state that at low dosages it assists in overcoming the adverse tear strength effects that can be an undesirable feature of such finishes, and at higher concentrations it enables combined water-repellent and crease resistant effects to be obtained.

Worsted Spinners New President

Mr. F. T. Sobey (chairman and managing director, E. Wadsworth and Son Ltd., worsted spinners, Cleckheaton) has been elected president of the Worsted Spinners' Federation in succession to Mr. M. W. Shelton. The new senior vice-president is Mr. J. M. Horsfall (managing director, J. C. Horsfall and Sons Ltd., Glusburn) and junior vice-president, Mr. B. Turner (managing director, Benson Turner and Son Ltd., Bradford).

* * *

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New Companies

Texylen (Great Britain) Ltd. Private. Reg. Feb. 4. Capital £20,000 in £1 shares. Manufacturers, merchants and importers of chemicals and dyestuffs, etc. Solicitors: Paisner and Co., 44 Bedford Square, W.C.1.

Fabriques (Belgium) Ltd. Private. Reg. Feb. 9. Capital £2,000 in £1 shares. Importers, exporters, and dealers in merchandise of all kinds, including surplus stores and equipment, silk, satin, wool, velvet and textiles. Registered Office: 75 Wigmore Street, W.1.

Devin Ltd. Private. Reg. Feb. 9. Capital £1,000 in £1 shares. Dyers, printers and textile converters. Solicitors: Evans, Baker and Co., 8 Queen Anne Street, W.1.

Kirdray Ltd. Private. Reg. Feb. 10. Capital £1,000 in £1 shares. Manufacturers, etc. Registered Office: Station Works, Wellhouse Road, Barnoldswick.

Thorpeside Mills Ltd. Private. Reg. Feb. 16. Capital £1,000 in £1 shares. Textile merchants, manufacturers and dealers in natural and synthetic fibres. Registered Office: 71 Whitworth Street, Manchester 1.

Winter and Stansfield Ltd. Private. Reg. Feb. 20. Capital £5,000 in £1 shares. Commission yarn winders, twisters, reelers, ballers. Registered Office: 27 Ashwood Street, Dudley Hill, Bradford 4.

Berend and Aldridge Ltd. Private. Reg. Feb. 20. Capital £2,500 in £1 shares. Manufacturers. Registered Office: 25 Ashwood Street, Dudley Hill, Bradford 4.

Greenbank Textiles Ltd. Private. Reg. Feb. 23. Capital £200 in £1 shares. Manufacturers and dealers in cotton, cloths, etc. Registered Office: Hall Carr Mill, Rawtenstall.

H. G. Pickles (Textile Combs) Ltd. Private. Reg. Feb. 24. Capital £5,000 in £1 shares. Manufacturers, repairers and dealers in textile combs, hackles, brushes, etc. Registered Office: 14A Richard Street, Bradford.

Bowling Blenders and Willeyers Ltd. Private. Reg. Feb. 27. Capital £2,000 in £1 shares. Reclaimers of wool, cotton and other fibrous substances. Registered Office: Ellinthorpe Street, Bradford 4.

Williams, Wilson and Co. (Cotton) Ltd Private. Reg. March 3. Capital £20,000 in £1 shares. Raw cotton merchant brokers, agents and arbitrators, etc. Registered office: 108 Cotton Exchange Buildings, Liverpool 3.

Hellawell and Fielding Ltd. Private. Reg. March 4. Capital £2 000 in £1 shares. Weavers and commission weavers. Registered office: The Square Mill, Milnsbridge, Huddersfield.

J. W. Wearn Ltd. Private. Reg. March 5. Capital £1,000 in £1 shares. Manufacturers and dealers in wool and woollen goods, etc. Registered office: 154 Upper New Walk, Leicester.

L. and S. Abbey Ltd. Private. Reg. March 6. Capital £10,000 in £1 shares. Spinners of worsted yarn, yarns, knitting materials, etc. Solicitors: Whitfield Son and Hallam, 29 Union Street, Dewsbury.

H. Pratt (Jacquard Designers) Ltd. Private. Reg. March 6. Capital £1,000 in £1 shares. Jacquard designer. Registered office: 6 Tariff Street, Manchester.

H. Laycock and Son (Yarn Doublers) Ossett Ltd. Private. Reg. March 9. Capital £2,000 in £1 shares. Registered office: Prospect Road, Ossett, Yorkshire.

Lucas, McKendrick Ltd. Private. Reg. March 11. Capital £2,000 in £1 shares. Manufacturers of leather goods, linings, etc. Registered office: 52 Princess Street, Manchester 1.

Harry Sanderson and Co. (Huddersfield) Ltd. Private. Reg. March 11. Capital £10,000 in £1 shares. Manufacturers and dealers in cloth, wool, worsted, gaberdines, etc. Solicitors: Louis Godlove and Waterman, Leeds 1.

Gaynights Sheets Ltd. Private. Reg. March 11. Capital £1,000 in £1 shares. Merchants and merchant-converters of textiles, cloths and piece goods, etc. Registered office: 79 Mosley Street, Manchester 2.

P. C. Porter (Hosiery) Ltd. Private. Reg. March 11. Capital £5,000 in £1 shares. Hosiery manufacturers. Registered office: 10 Britannia Street, Leicester.

Nottingham Bobbin Nets Ltd.—Private. Reg. March 11. Capital £1,000 in £1 shares. Manufacturers and dealers in lace, etc. Registered office: 2 King's Walk, Nottingham.

E. Dalby and Co. Ltd. Private. Reg. March 12. Capital £10,000 in £1 shares. Textile merchants. Registered office: 11 Friday Street, Manchester 4.

Milletts (Wembley) Ltd. Private. Reg. March 12. Capital £1,000 in £1 shares. Silk mercers, etc. Registered office: 18 Manchester Street W.1.

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Fosse Dyeworks Ltd., Syston, Leicester.

H. Harrison & Co. (Finishers) Ltd., Leicester.

Hicking Pentecost & Co. (N.I.) Ltd., Ballymena, Co. Antrim.

Lindley & Lindley, Nottingham.

Loughborough Dyeworks Ltd., Loughborough, Leicester.

James McHaffie & Son Ltd., Neilston, nr. Glasgow.

Martins (Leicester) Ltd., Leicester.

Murray Bros. & Co. Ltd., (branch of Spray & Burgass Ltd.), Bagnall Dye Works, Bulwell, Nottingham.

Robinson Bros. (Greenfield) Ltd., Greenfield, Yorkshire.

W. E. Saxby (Leicester) Ltd., Leicester.

W. E. Saxby (Nottingham) Ltd., Nottingham.

Scottish Wool Bleachers & Dyers Ltd., Barrhead, nr. Glasgow.

South Knighton Dye Works Ltd., Leicester.

The Springfield Hosiery Finishing Co. Ltd., Hucknall Lane, Bulwell, Nottingham.

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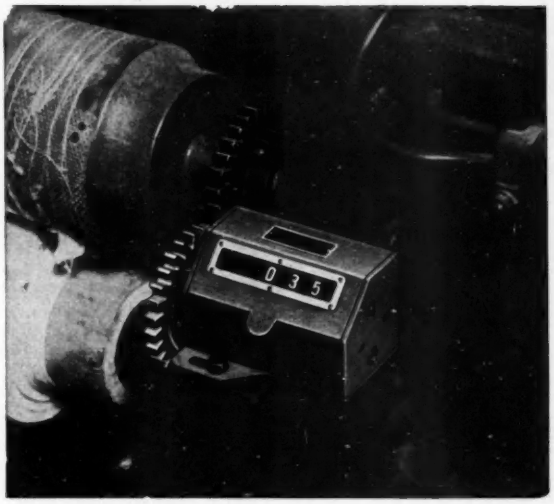

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RECENT TEXTILE PATENTS

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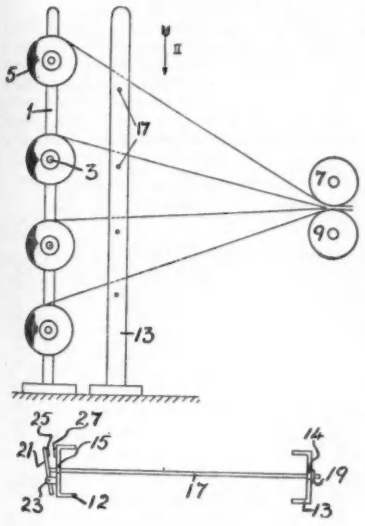
789,604 Card Stop Motion

L. HINCHLIFFE AND SONS LTD., *Hartcliffe Mills, Denby Vale, Huddersfield.*

Feeding mechanism for carding machines of the ball and bank feed type of mechanism. The feed mechanism comprises two members 1 having between them a series of supporting bars 3, with a number of rolls of sliver 5 mounted on each bar. The free end of each roll is passed between the nip of a pair of feed rollers 7 and 9 of a carding machine and is passed by the rollers to the feed conveyor (not shown) of the carding machine. A second frame between frame 1 and the feed rollers comprises a pair of members 12 and 13, one at each side of the path of the slivers towards the feed rollers. Member 13 has

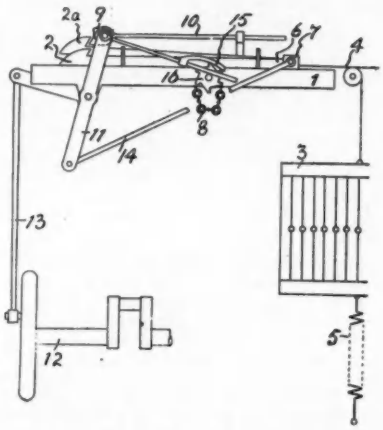


a series of holes 14, and member 12 has a series of holes 15 aligned with holes 14. A linen thread 17 is passed through each of the holes 14 and has a knot 19 on its end to prevent the thread passing completely through the hole. The thread is then passed under the lengths of sliver extending to the feed rollers and passed through the corresponding hole 15, the end of the thread being attached to a lever 21 mounted on a bracket 23. A contact 25 is mounted on one end of lever 21 and when the lever is turned about its pivot the contact engages a contact 27. The lever is biased to maintain contact 25 away from contact 27. The contact 27 is connected to a relay shown, which is adapted to actuate the feed roller stop motion. When a break occurs in any one of the slivers, one of the broken ends will fall on to the thread 17 and will deflect the thread in the direction of the arrow "A" whereby lever 21 is turned about its pivot and contact 25 moved into engagement with contact 27.

789,954 Improved Dobbies

G. J. M. TER HORST, 45 *Helmerhoekweg, Enschede, Holland.*

A dobby or heald-operating mechanism for looms to provide a simple and reliable dobby having a closed shed. A number of hooks 2, 2a are mounted for longitudinal movement in frame 1. Each of a number of healds 3 is connected, through cables 4,

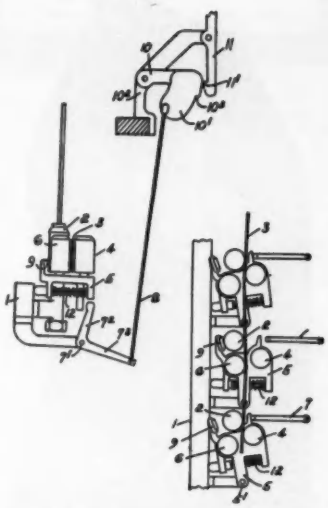


with one hook and, with the assistance of springs 5, pulls the hook with its end 6 against an abutment-bar 7. The selecting device for lifting the hooks comprises a pattern chain 8. A knife 9 which is common to all hooks and has a guide rod 10 is carried by two swing levers 11 driven, through a rod 13, by a crank shaft 12. Rods 14 connect the ends of levers 11 with the abutment-bar 7 which is movable in the longitudinal direction of the hooks. Rotation of shaft 12 causes knife 9 to engage the lifted hooks 2a and move them to the left, whereby the healds connected to the hooks are lifted. At the same time, abutment bar 7 moves to the right, causing the healds to pull the hooks 2 to the right. In consequence, the latter healds move downwards, so that the shed is opened. During the return movement a paw 115 connected to knife 9 rotates a ratchet wheel 16 secured to the shaft of the pattern cylinder through one tooth, so that the device is set for the next pick.

790,122 Driving Arrangement for Spinning and Twisting Machines

J. AND T. BOYD LTD., and H. A. BOYD, *Shettleston Iron Works, Shettleston, Glasgow.*

Improved driving arrangements for spindles or flyers in spinning and twisting machines. 3 denotes a snake-like belt mounted behind the spindles 2 and running the length of the machine. 4 denotes vertical whorls mounted behind the belt on one end of a horizontal swing lever 5 pivoted at 5^1 to the rail 1. A second vertical whorl 6 is mounted on the lever 5 adjacent to the front face of the belt. A compression

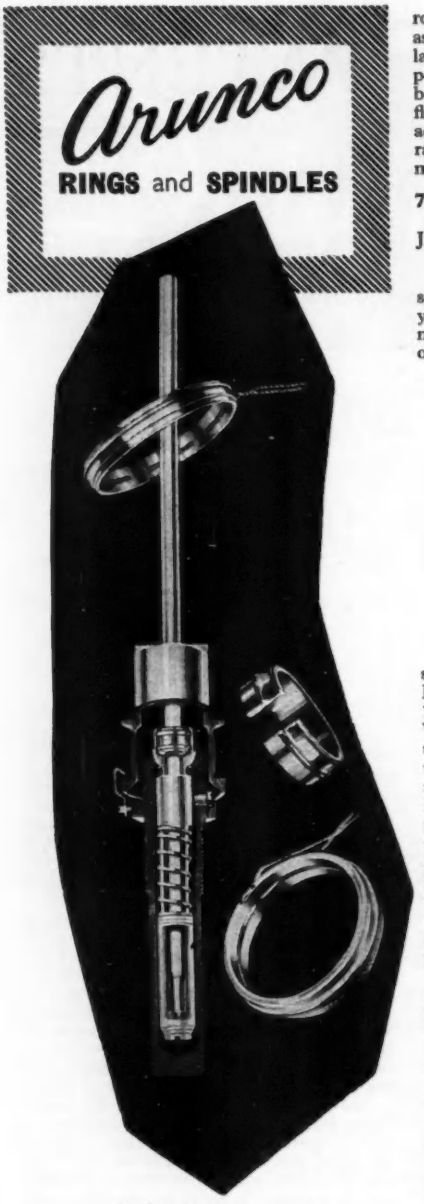


spring 12 between lever 5 and the rail normally urges the whorl 4 to a position clear of the belt. Behind lever 5, is mounted a bell-crank lever 7 pivoted at 7^1, one limb 7^2 being adapted to engage lever 5. The other limb 7^3 is connected by a rigid link 8 to a lever 10 provided with a weight 10^1 and pivoted above the whorl to a fixed part 10^2 of the machine. Pivoted to part 10^2 is a weighted lever 11 provided with a projection 11^1, engageable with a notch 10^3 in lever 10. When the levers 10 and 11 are swung to engage the projection 11^1 with the notch 10^3 in lever 10, the link 8 is pulled to cause the arm 7^2 to engage lever 5 which urges the whorl against the belt which is urged in turn against the spindle to rotate it. When lever 10 is moved to disengage the projection 11^1, the lever swings down under the influence of the weight, the link 8 being pushed to disengage the bell-crank lever 7 from lever 5. The spring 12 urges the whorl out of engagement with the belt and urges the whorl 6 to engage the belt and to maintain it out of engagement with the spindle. Associated with lever 5 is a brake 9 adapted, when the spring 12 urges the whorl 6 to engage and to stop rotation of the spindle.

790,072 Automatic Lap Doffing Mechanisms

M. STEIN, 6 *Gábor Áron-utca, Budapest* I, *Hungary.*

An automatic lap-doffing mechanism for lap machines of the type in which a lap is wound on driven fluted carrier rolls under pressure from rack heads, to doff a complete lap roll and feed an empty lap rod after a predetermined length of lap has been obtained. The carrier rolls are driven at a uniform speed from a scutcher through a one-way clutch, and a reversible motor drive is provided for imparting a positive reciprocal vertical motion to the racks and increased rotational motion to the carrier



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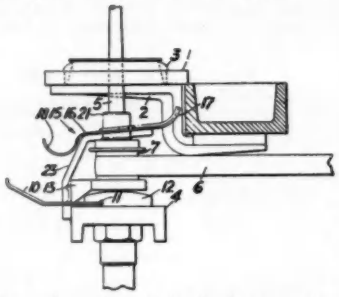
rolls during the upward stroke of the racks associated with doffing so as to detach the lap while the scutcher is running. For this purpose a one-way clutch is provided between the reversible motor drive and the fluted rolls. Control means provided are actuated in the extreme positions of the racks, and for reversing the reversible motor drive.

791,480 Yarn Protection in Wet Spinning

JAMES MACKIE AND SONS LTD., *Albert Foundry, Belfast*

Describes an improvement in the wet spinning of flax, hemp and other bast fibre yarns on ring frames. A fixed ring rail 1 mounted on brackets 2 supports a number of rings 3 each of which has a large central



space through which liquid can drop. Each spindle is controlled by a knee brake 10 pivoted at 11 to the spindle bolster 12. When it is required to stop any spindle, upward pressure of the operator's knee on the brake presses the brake pad 13 against the flange of the wharve, thereby stopping it. The driving tapes 6 are made of material which is rotted by the liquid falling through the opening in the spinning rings and to overcome this difficulty a cover 15 is fitted in the space between the tops of the wharves 7 and the underside of the ring rail. This cover is formed as a non-corrosive sheet metal pressing and the main portion of the cover slopes forwardly as at 16. The rear edge of the cover is turned up at 17 to constitute a rim, while the front edge constitutes a gutter 18. Each spindle passes through a corresponding opening 20 in the cover, and each opening is extended as a slot of width just greater than the diameter of the base of a spindle 5. In assembly, the cover is slid inwardly with the slots receiving the bases of the spindles and when the spindles have entered the openings, the cover is then dropped into position so that the portions of the bolster 21 pass into the openings. The cover is then held in position on a support 23.

791,553 Ornamentation of Fabrics

BRADFORD DYERS' ASSOCIATION LTD., 39 *Well Street, Bradford*, and BLEACHERS' ASSOCIATION LTD., *Blackfriars House, Manchester*.

A compressively shrinkable sheet material is ornamented by compressively shrinking the material in contact with a second material which buckles, so that the buckles formed in the second material are transferred to the first material. The invention is particularly applicable to the ornamentation of fabrics.

791,626 Automatic Shuttle Changing Looms

WEM. AUTO-LOOMS LTD., *Brunswick Works, Canterbury Street, Blackburn*.

An automatic shuttle change loom is provided with a pivoted shuttle loader, adapted to be rocked by mechanism operated from a weft feeler, and provided with a cam engaged by a resiliently mounted member. The cam is so formed that the member will urge the shuttle loader into one extreme position, until the cam is moved by the movement of the shuttle loader past a critical position, after which the member will urge the shuttle loader into another extreme position.

791,723 Forming Mineral Fibres

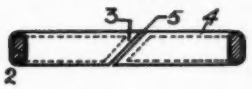
R. M. DOWNEY, *Route No.* 1, *Roann, Indiana, U.S.A.*

A method of forming mineral fibres comprises delivering a stream of molten material in front of a surface which revolves in a vertical plane, and directing a stream of fluid upward and forward of the surface, the stream of fluid being contiguous to the surface. The stream of fluid is turned rearwardly on to the stream of molten material for forcing it on to the surface, and the material from the surface is centrifuged to produce fibres and the fibres are dispelled from the rotor as rapidly as they are formed.

791,950 Balloon Control in Ring Spinning

FAIRBAIRN LAWSON COMBE BARBOUR LTD., *Wellington Foundry, Leeds* 1.

Describes an improved form of balloon control for ring spinning. A metal ring 2 is provided with a slit 3, and the inner and outer surfaces of the ring are completely coated with a layer 4 of a suitable plastic such as polythene or nylon. The inner surface of the plastic layer must be finished



in such a manner as to have a smooth contour, so that when used to guide the thread balloon the thread does not rub or catch on any projecting particles on the inner surface of the ring. The dimensions of the slit are preferably such that although the coating of plastic overlaps the ends of the ring by a small amount, gap 5 is still left. The yarn can then be inserted in the ring without threading it through the centre.

792,344 Automatic Shuttle-Changing on Ribbon Looms

G. M. V. J. CHOUPIN, 9 *Rue de la Bourse, Saint Etienne (Loire), France*.

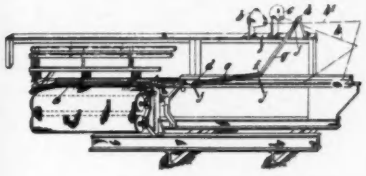
Describes a ribbon loom with automatic changing of shuttle fronts, wherein each magazine for shuttle fronts is provided with an extension on to which each exhausted shuttle front is shifted temporarily so as to remain for some time in the immediate proximity of the fabric before its thread is severed, after which the exhausted shuttle front is removed in a definite manner by a traction or a thrust which is exerted only after several strokes of the slay. In this way the removal of the exhausted shuttle front is performed in two stages, while the weft end on the exhausted shuttle front is severed only after the laying of several picks from the next shuttle front.

792,378 Weft Insertion on Shuttleless Loom

WEAVING RESEARCH AND TEXTILE COMMISSION AGENTS LTD., *Ballamoar Castle, Jurby, Isle of Man*.

Refers to looms of the type in which the weft is inserted into the warp shed by one

or more reciprocatory inserting spears. Each weft inserting spear *a* transfers two weft threads from two stationary weft packages *b* and *c* into two sets of warp threads arranged one above the other to produce two fabrics simultaneously. Two weft inserting spears insert weft into the warp sheds from opposite sides of the loom in the usual manner. Connected at *d* to the end of the spear is a link *e* which is connected at *f* to a further link *g* and the



latter is connected at *h* to a fixed bar *i*. There are yarn guide eyes *j* at each pivotal point *h*, *f* and *d* so that the weft follows the configuration of the elbow formed by the links *e* and *g* as the spear moves into and out of the warp shed. The full line position of the links *e* and *g* corresponds to the spear being nearly across the warp shed, and the dotted line position k^1 of the links is shown where the spear is completely out of the warp shed. In positions of the spear the length of thread between each package *b* or *c* and the delivery end of the spear is practically constant.

793,680 Stripping Web from Card Doffer

CARDING SPECIALISTS (CANADA) LTD., 318 *Lytton Boulevard, Toronto, Ontario, Canada.*

Treatment of carded webs by passing them between a pair of pressure rollers, and stripping the web from the pressure rollers by means of a card-clothed roller which co-operates with one or both pressure rollers. An additional roller is arranged to co-operate with both the doffer roller, and the pressure roller which is rotating in the opposite direction to the doffer roller. This additional roller may be plain, grooved or fluted, and it may have a smooth or roughened surface as found desirable. The additional roller is preferably driven in the opposite direction to the doffer roller (and hence in the same direction as the pressure roller).

793,715 Manufacture of Looped Yarns

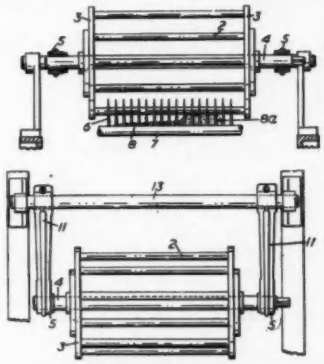
ALGEMENE KUNSTZIJDE UNIE N.V., 76 *Velperweg, Arnhem, Holland.*

A device for the manufacture of a looped yarn from yarn composed of a number of filaments, comprising a tube in one end of which a jet of gas debouches and the other end of which is open and in the wall of which a yarn supply opening is provided. A first roller guides a yarn to the supply opening, and a second roller guides a yarn discharged from the open end of the tube. Both rollers are connected together and are freely rotatable around a common axis, braking mechanism is operated by movement of a guide which is movable against the action of a spring or a weight.

793,804 Hackling Machines

JAMES MACKIE AND SONS LTD., *Albert Foundry, Belfast, N. Ireland.*

Relates to hackling machines for long staple fibres and is concerned with the arrangement of the lantern roller used in conjunction with the slow-running hackle bars. The lantern roller comprises rods 2 between plates 3 mounted on an axle 4. The axle turns freely in bearings 5 and the roller is driven by engagement between the bars 2 and the hackle pins 6 which are mounted on hackle bars 7. Bearings 5 are



mounted at the ends of arms 11 which are secured to a common rocker shaft 13. Since both the arms 11 are connected to the rocker shaft, they rise and fall in unison as the shaft rocks and, consequently, the axis of the lantern roller is maintained horizontal and parallel with the hackle bars. If the material 8 is thicker at one point across the width of the machine, as at 8*a*, the pressure exerted by the lantern roller is concentrated at the point of maximum thickness and tends to flatten out any lumps to increase the uniformity of the product.

793,952 Winding Rolls or Packages of Jute, etc., Sliver

DOUGLAS FRASER AND SONS LTD., *Westburn Foundry, Arbroath, Angus, Scotland,* and THE BRITISH JUTE TRADE RESEARCH ASSOCIATION.

An improved machine for winding rolls or sliver of jute, manilla, sisal or other long staple fibres. The method of winding includes the step of varving the frequency of traverse from one end to the other end of the roll and back again in such wise that the effects on draft are maintained negligible. The values of the ratio of the instantaneous circumference of the roll to the sliver-laying wave length are maintained, for as long as possible, remote from whole numbers or mixed numbers of the form $2n + 1 \div 2$, where "n" is an integer and are caused, when necessary, to pass rapidly through those values of the ratio which consist of such numbers.

794,114 Package and Balloon Control in Spinning, Doubling, etc.

PRINCE-SMITH AND STELLS LTD., *Burlington Shed, Keighley.*

Method of twisting yarns, comprises feeding the yarn to a rotating extensible package support through a device that carries it in an orbit about the package support. The package support comprises nested co-axial inner and outer rigid members that are movable axially relatively to one another, and in which the outer member is moved away from the feeding means. During such movement, the support is extended by moving the inner member in the direction opposite to that of the movement of the outer member, so that a package is built up on the outer member and on the extended inner member.

794,533 Beam Flange Adjustment

W. GROB, 45 *Burstwiesenstrasse, Zurich, Switzerland.*

Describes a warp beam with limiting flanges adjustable relatively to each other by means of screw threads. The beam comprises a single tubular member formed with a screw thread at each end to hold the limiting flanges, which thread has a pitch several times larger than the width of the thread groove.

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THE Proprietor of British Patent No. 740287 is prepared to sell the patent or to licence British manufacturers to work thereunder. It relates to "Improved Blanket and Napped Material therefor." Address: Boult, Wade and Tennant, 112 Hatton Garden, London, E.C.1.

THE Proprietors of British Patents Nos. 699633, 699657 and 717646 are prepared to sell the patents or to licence British manufacturers to work thereunder. They relate to "Improvements in or relating to Pile Fabrics and Method of Manufacturing same," "Improvements in or relating to a Machine for Manufacturing a Reversible Pile Fabric" and "Improved Method of and Apparatus for the Production of Reversible Pile Fabrics" respectively. Address: Boult, Wade and Tennant, 112 Hatton Garden, London, E.C.1.

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Particulars from the Solicitors, Bartlett and Gluckstein, 199 Piccadilly, W.1, and Leopold Farmer and Sons, Auctioneers, Surveyors and Valuers, 46 Gresham Street, E.C.2. *Tel*: MON 3422 (8 lines).

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WANTED. Livesey type Sectional Warping Mill, size 9/4. Box No. TH17, "Textile Manufacturer," 31 King Street West, Manchester 3.

WANTED. Wool Scouring Set, preferably Four Bowls. Please state full particulars and where can be seen to Box No. TH18, "Textile Manufacturer," 31 King Street West, Manchester 3.

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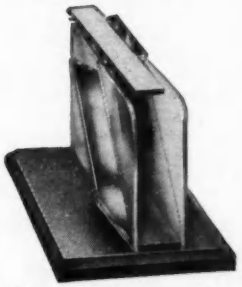

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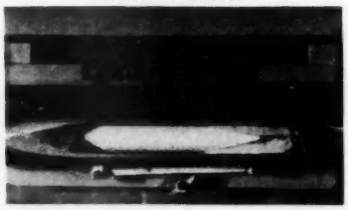

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